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REARING AND FATTENING OF PIGS.

That there is an enormous increase in the consumption of bacon, hams and small pork in this country could, if necessary, be easily proved by reference to the importation returns. Of bacon, there is now imported about 250,000 tons annually; in addition to this, our imports of hams, lard and fresh pork are enormous, and the whole costs the country about £25,000,000 a year, or more than double as much as we paid for the same kinds of imported food as recently as ten years since. It is alleged that our home manufacture of pork products has also increased, owing to the fact that greater attention has been paid to the feeding and the earlier maturity of our home-bred pigs. There is little doubt that a great many pig-breeders have given up the wasteful system of keeping their growing pigs as stores for many months, and that others have turned their attention to the production of so-called porker pigs whose dead weight is from 60 to 70 lb. each, and by these means have increased their annual output of pork; yet as one travels the country round it is impossible to avoid coming to the conclusion that very much improvement is still possible and even necessary before anything approaching perfection is arrived at in the quantity and quality of the pigs we produce in these Islands.

I am not inclined to assent to the assertions of those who delight in attempting to prove that our farmers are fearfully neglectful of their golden opportunities in that they fail to produce the major portion of the pork products which we now import, since I do not think that we could with profit extend our pig breeding to anything approaching the extent necessary

to render us independent of imported pork products, but there appears to be little doubt that we might very largely increase our home production of pork with much profit to ourselves and a considerable manurial improvement to our farms. If this last contention be, as I maintain it to be, a sound one, then it behoves those of us who are dependent on the land for a livelihood to seriously consider the best steps to take to free us from that which must be considered a neglect of our opportunities and of our duty.

One of the first considerations of a manufacturer is the quantity and quality of his raw material; so must the pig-keeper, whose object is to produce store pigs for sale or to manufacture pork, *carefully study his raw material in the shape of his stock* or breeding pigs. On this point again I fear that there is little doubt that there is much room for improvement. Should anyone be dubious as to this, let him pay a visit to the nearest pig market or fair and carefully examine the pigs of all ages there offered for sale. He will find many, if not a large proportion, of the pigs which cannot have paid the producer, and which cannot possibly be converted into meat of even average quality. The particular deficiencies or failings of the pigs will vary greatly according to the district in which the fair or market be held, but in nearly all parts of the country the common pig will be found to be lacking in early maturity and quality. Ill-formed, gaunt, coarse-boned, badly-nourished store pigs, and boars and sows for *breeding purposes, will be found mixed* up with a few pigs which are evidently the produce of well-bred parents, and a good many which have had much care bestowed on them after but not before their birth. In no department on the farm does there appear to have been less progress than in the breeding of pigs. This may have arisen from the general neglect of the farm pig, or it may be partially due to the far too frequent want of success which has in times past attended the purchase and use of so-called pedigree pigs bought at shows, or from successful exhibitors whose object has been to gain money and fame rather than to really improve the particular breed of pig which they exhibit; but, be the cause what it may, the results are not creditable to those directly concerned or beneficial to the consumer.

It may be advisable to briefly discuss those particular points in which the ordinary farm pig is deficient, and then to attempt to discover one or more remedies. One of the great checks to the improvement of pigs appears to be the enormous amount of local prejudice as to the colour and type of pig. It is difficult to obtain from those most staunch in the breeding of pigs of a certain colour the slightest approach to a good and sufficient reason for the fancy for that particular colour. The general reply is that pigs of that colour always do best, but when this assertion is closely examined no proof can be given of its correctness, and it usually rests on the alleged fact that their fathers had proved the truth of the assertion, or something of the kind, and that what was good enough for their forbears is good enough for them. Here rests the chief, if not the whole, cause for this persistence in a continuance of the prejudice for or against pigs of particular colours. This fancy is not confined to the producers or pig-breeders, but is greatly shared by the consumers, who are, perhaps, influenced to a very great extent by the local butchers, who naturally wish that their customers should desire to purchase that particular kind of article which can be most cheaply and most readily obtained in the district.

It would be simply a waste of time to attempt to convince persons of this class that the pork from a carcase of a white pig would be exactly similar to that from a black-skinned pig if both were of the same type and character and fed alike. If you so stated you would be met with a simple denial of its possibility; but if you proceeded to ask for a possible cause you 'd fail to obtain the slightest indication of any. In some districts in the West of England a white pig was, until late years, completely boycotted—exactly why, no one appeared to be able to state—and, so far as I have discovered, the chief cause for this objection to a white-skinned pig has been the fact that the carcase has not so nice an appearance after the hair has been scorched or singed off as the black-skinned pig, the fashion being to scorch off the hair by fire instead of, as in the midland and northern counties, removing it by scalding. Again, it has been stated that the chief reasons for the white pig's being preferred in the latter counties is that its scalded carcase presents a nicer

appearance than does that of a scalded black-skinned pig. We know that in Ireland the bacon curers prefer their fat pigs to have white skins; and they declare that they are able to produce a more presentable side of bacon from the white- than from the black-haired pig. It is also held by many residents in the south-western counties that the pork from a scorched pig is infinitely more palatable than from a scalded pig. Here, again, it is difficult to discover any sufficient reason for the assertion; certainly there may remain a slight flavour of the burning straw or hair, and in this manner more flavour may rest with the scorched carcase; and habit may have rendered this peculiar flavour—if it exists—appreciated in much the same way as the American bacon or hams which have been smeared with the so-called liquid extract of smoke in order to give them a flavour somewhat similar to the salted and dried meats which have been subjected to the fumes of burning or smouldering oak chips or stands. A flavour is thus manufactured which appeals to palates not so delicately constituted as to be able to appreciate the flavour of a choice piece of pork, ham, or bacon in its natural condition.

From the foregoing remarks it will be evident that the choice of a particular breed of pig has in the past been largely affected by anything rather than the points possessed by the pigs of the various improved breeds. It is to be hoped that with the extension of knowledge these fancies will gradually give way.

There are considerable variations in the opinions of pig-keepers as to the points which should be possessed by the boar selected for use in one's herd, or for the use of one's neighbours. One person with a certain amount of experience will declare that he has been most successful when he has used a big-framed, strong-boned, and rather coarse boar, whilst his friend, perhaps equally experienced, will hold as strongly that a well-built, thick, compact boar of fine bone and quality is the better. My experience, gained during nearly half a century, leads me to uphold the latter view, even when the object is to produce pigs for sale off the sow. The produce of a thick compact boar and a large-framed, good quality sow will always command a higher price than will the produce of the coarser boar, although the latter youngsters may appear to the novice to be the larger pigs. Then, if the object be

to breed pigs for fatting on one's own farm, the advantage of using the compact, good quality boar will be enormously increased: the pigs will fatten much more readily—indeed, at any period of their existence—and on a considerably smaller quantity of food, while the value per stone of the pork will be decidedly higher. There never was a period when quality of meat was more considered by the consumer and, of necessity, by the purveyor of meat. This point has not hitherto received so much attention from pig-breeders as it deserves, and one might almost include breeders of all kinds of domesticated animals intended for human food. Farmers have been inclined to believe that the consumer will be content with that which is placed before him, provided that it is home produce. This is a mistake; the public care just as little whence comes their daily bread and meat as does the farmer care who manufactures the implements with which he tills his farm. Every careful tradesman takes infinite pains to discover the wants and fancies of the public and does his best to satisfy those wants, but in too many instances farmers have not adopted this common-sense system, at least with regard to pig feeding, &c.

In the good old times of the long-ago, before the Danes, the Canadians, and, indeed, the inhabitants of most countries, applied themselves to furnishing the necessaries and luxuries demanded by the somewhat fanciful and extravagant English public, the latter were compelled to make the best of home farm-produce; now, however, the highest prices and the keenest demand, especially in slack markets, fall to those articles which are presented in the best form, and of the size, quality and character which most nearly meet the wishes of the consuming classes. In other words, to rear pigs with a certainty of success, we must have quality in the parents. The chief object in selecting a boar must, therefore, be to select such an animal as will more probably beget the kind of pig which is most readily and at the highest price sold to the buyer. If, as nearly every enlightened breeder declares, the boar is to be of a pure breed, there is plenty of choice, both as to size and colour, for the purchaser. There is the Berkshire, black in colour, with so-called white points, the Large Black, the Tamworth and the Large and the Middle

White Yorkshires. The first and last kinds are generally considered the best for the production of London porker pigs and small pork, whilst the other three varieties are said to be more suitable for bacon curing and for those heavy pigs which are still preferred in the more northern counties of England. As I am considerably interested in the breeding and sale of two of the varieties mentioned, some persons may not look upon me as exactly one whose advice they would seek when selecting a boar; but this I do most earnestly desire to impress upon pig-breeders, that they should have a really good specimen of the particular breed they decide upon. The extra cost will be repaid in a few months if many sows are kept, while the produce will be a continual source of pleasure.

Perhaps there is not so great a divergence in the general opinion as to the type of sow which should be selected. Of course, each particular kind of pure-bred pig has its own sturdy champions; this is a phase of the subject which is best left for the present. The question of colour may be deserving of some consideration, but the chief and most important thing is to select a brood sow so formed and of such a disposition that a good and thrifty litter from her is almost a certainty, provided that care and attention be bestowed upon her and her young family.

It is difficult to decide which of the many good qualities a sow should possess is the most important. I would place docility and the having had a good mother amongst the urgent necessities in a brood sow. A bad-tempered or nervous sow is bound to be a source of trouble and annoyance, while the litter reared by her will be few in number and of less value per head than the pigs of a litter from a good sow. Bad temper leads to many troubles; amongst these will be found the horrid habit of eating the little pigs, the treading on and injuring the newly-born youngsters, a scarcity of milk or its unhealthiness, occasional injury to the attendant, and frequent damage to the pig-sty; in fact, a bad-tempered yelt ought never to be kept for breeding purposes, as not only is she a nuisance, but her produce are almost sure to inherit the weakness of their dam, which will certainly result in unrest and waste of food when the pigs are being fattened. The buyer of a yelt intended to be brought up

for a sow should see the dam ; if this be not possible, then purchase the yelt only from some pig-breeder who has the credit of being a good pig-master ; the extra cost will be more than repaid in the returns from the first litter of pigs. The young sow chosen should be of good size and quality, light in the fore-quarters, and have at least twelve teats, evenly placed, and commencing as nearly as possible behind the fore legs. Many sows have teats of varying size, others have so-called blind teats ; avoid these, as they will only lead to the starvation and death of the unfortunate piglings which select those teats for their very own. Be certain that the dam was prolific and a good suckler or milker ; these qualities are very important and are also hereditary to a great extent. The hair, the skin, and the bone should all be fine as well as the quality of flesh ; with these possessions early maturity is surely indicated.

Having purchased such a young yelt as I have endeavoured to pourtray, keep it well and give it plenty of exercise until it has attained the age of eight to ten months, and then have it mated with a young pure-bred boar bred on similar lines. When the young sow is about half gone with pig she should be fed liberally on good and nutritious food, and allowed her liberty as far as possible. It is always better to have a down-pigging yelt in fresh rather than low condition, since if she be, as she ought to be, a good suckler and prolific, she is certain to become poor ere her pigs are weaned. There is a difference of opinion as to the number of pigs which the young sow should be allowed to rear. Probably the question does not arise so frequently as it should, since so few pig-breeders have paid sufficient attention to the fecundity of their sows, but I have known yelts produce as many as nineteen youngsters ; on occasions such as this a decision has to be arrived at as to how many of the piglings shall be left on the mother. I am inclined to think that it is advisable to leave as many pigs on the young sow as she can, with good food and attention, rear properly, even if the sow has to be rested for a short time after the pigs are weaned, or the little ones are allowed to continue on the sow for as long a period as three months. It is held by many observant men that the pigs of the subsequent litters which suck those teats which were utilised with the first litter thrive better than those youngsters

which take to the previously unused paps. I do not accept this *in its entirety*, but I have observed several instances where the effect appeared to be as stated.

The length of time during which the little pigs are allowed to remain on the sow varies in different counties, and even districts —the time of year as well as the age of the dam and the number of youngsters should have an influence. As a rule the pigs should be quite able to take care of themselves when they are eight weeks old if they have been gradually weaned and have also learned to eat. My system is to give the little pigs a small quantity of whole wheat when they are about a month old; the mother is turned out of the sty for an hour or two for exercise and to eat grass in the summer months. The little pigs will very quickly learn to pick up the kernels of wheat, whilst the sow will be none the worse from eating any wheat which the pigs may have left. The sow should be gradually kept away from the pigs a longer time, until at last her milk will have pretty well dried up, and thus trouble with the udder will be avoided.

I have yet to find anything better than so-called hogs-meal—sharps, randans, thirds, &c.—on which to feed the suckling sows and the young and newly-weaned pigs. Sometimes the milk of the sow will be too rich or too plentiful; then it is advisable to add say one-eighth of broad bran to her food for a few days; this will have a laxative effect on the sow, and it also appears to reduce the richness of the milk. Occasionally it may be advisable to feed the sow three times a day after she has farrowed four or five weeks and has a large family dependent on her, or she may become too low in condition, or become affected with partial paralysis of the muscles of the back. This will be shown by the inability of the sow to walk comfortably, and in severe cases she will be unable to rise. On such occasions the best course to pursue is to wean the pigs as quickly as possible, to give medicine to regulate the bowels and the kidneys, to apply some stimulant along the back, and to feed frequently on small quantities of easily digested food. The few cases which have occurred in my own herd have readily responded to treatment of this nature, and have not been injured for breeding purposes.

The question as to the best period of the year for the arrival

of the little pigs is of rather a more complicated character than is generally supposed. Although the object of pig breeding is the same all the world over—the realisation of a profit—yet the manner in which this industry can be most profitably carried on varies considerably; one of the reasons for this is the supply of cheap food at certain periods of the year. For instance, in those districts where cheese or butter-making is one of the chief pursuits of the farmers, the early spring and summer pigs are the more profitable, from the following causes: there is a very large supply at no great cost of separated or skim milk, butter-milk and whey, the price of fat pigs is almost always above the average of the year during the months of August and September, and the cost of fatting the pigs is less than during the cold weather. Dairy farmers and those who breed especially for them should therefore endeavour to have their sows farrow down early in the year. Amongst pig-keepers there exists an objection to early litters on account, they allege, of the cold weather. I am inclined to think that this fear is excessive. For many years it has been my custom to arrange for a considerable number of my sows to farrow in the month of January; this year the number was twenty and the litters averaged a trifle over twelve per litter from both sows and yelts, and I find that, with a little extra care when the pigs are first farrowed, if the cold is severe, the percentage of loss is not at all higher than with February or March litters, whilst there are two very great advantages: the pigs can be fattened out for the best trade, and the next litters will come in July or early August and have plenty of time to get strong before the cold, muggy weather of November arrives. This last month and October should be carefully avoided as months in which the sows farrow. The cold, damp days and very long nights appear to be most unsuitable for little pigs. Cold, provided it is dry and the pigs have sufficient litter, appears to have but comparatively little effect on young pigs. I am aware that some years since a considerable number of pigs were bred in November to furnish a supply of roast sucking pigs for Christmas, but that, like running little pigs on the stubbles to pick up the shelled corn, has almost become a memory of the past in many counties. Some few small farmers, who are able to employ

members of their own family to tend the pigs on the stubbles, still imagine that there is a profit in it, but the general opinion now is that the increased value of the pig after its course of shacking is not equal to the expense, whilst a certain loss attends the buying of pigs before harvest and selling them after roaming in the stubbles. The present system of feeding the pigs well from weaning, and fattening them ere they reach nine months old, is not compatible with the old-fashioned store period in the life of a pig.

On the question of the length of time it is profitable to breed from a sow, very divergent views are held. In several of the northern counties a very wasteful system used to be general—that of allowing a large proportion of the sow pigs to have one litter of pigs and then to fatten off the young sows. If such a plan be regularly followed it is most difficult to improve one's stock of pigs, as it is not always possible to ascertain with any certainty which young sows will mature into the most profitable brood sows, as when all the young sows, good and bad alike, are sacrificed, no improvement in the pigs can easily take place, but a falling off in prolificacy and the milking qualities of the sows is almost certain to be experienced. Only by the continued selection and retention for breeding purposes of the best young sows can one's pig stock be improved. In most counties there would also be the loss in the decreased value of the pork from the young sow which had bred pigs, whilst the flesh from the boar, which on this system is usually castrated and fatted with the sows, would be still less saleable.

The old-fashioned view that the pigs from yelts or young sows are always inferior to those from mature sows, and should never be kept for breeding purposes, is fast becoming very much modified. My experience leads me to believe that equally good boars and sows can be selected from the first as from the subsequent litters of a sow, provided that the sow is of a tribe noted for its early development. Some of my best breeding and exhibition pigs have been the produce of maiden sows.

The question as to whether it be most profitable to purchase young pigs or stores and to grow and fatten them, or to keep one or more sows and sell the produce as weaners, stores, or as fat pigs, must be settled by each pig-keeper in accordance with his

varying opportunities. These last are of many kinds. The pig-keeper may be in a district where weanling pigs are in very great demand, as, for instance, where many miners live, or in a district where a considerable amount of butter or cheese is made; in such cases it may prove to be more profitable to sell out the little pigs when they are ready to be weaned, as at no other time will they have paid the breeder better. Then some persons may be able to obtain at little expense a good grass run for their sows, or, if near a town or houses, where extensive establishments are kept up, a considerable quantity of kitchen refuse can be obtained cheaply, all of which will enable the pig-keeper to run his sows on at little expense between each farrowing on food which is not so suitable for young pigs. For the keeping of sows and the sale of the little pigs as weaners fewer premises are required than for the breeding and fatting the pigs. Less capital is also needed, and the sows need less attention save when the young pigs are about to arrive, and for three or four weeks subsequent to their arrival. On the other hand, breeding sows kept for selling the young pigs as weaners are not of much benefit as manure manufacturers to those who own or occupy land in the form of large garden, allotment, orchard or farm. For orchards especially is it desirable to fatten pigs so that the resulting manure can be utilised to enrich the soil on which the fruit trees are grown. In Kent and other counties where fruit culture is general the occupiers are becoming alive to the manurial benefits derivable from the consumption of corn by pigs in the orchards, as not only can the pigs be made to pay well for the food consumed, but the quantity of fruit is greatly increased and the size and quality improved. In particularly drawing attention to the greater use now made of pigs as improvers in orchards, I do not intend to suggest that great benefits are not derivable by gardeners and allotment holders, and, indeed, by all those who occupy land, as every one with experience will admit that the best and most lasting stimulant to vegetable growth is manure made by fatting pigs. Even persons who are not in the habit of keeping pigs readily admit this fact, but they excuse themselves for neglecting so good an opportunity on the ground that pigsties are so offensive. To a very great extent this is mainly due to want of care and cleanliness on the part of the persons in charge. A

very simple way of reducing the somewhat strong aroma from the pig-sty is to have the ashes thrown into it each day; its occupants will pick out all the largest cinders and convert them into pork, or they will act as a medicine, and so keep the pigs in better health, whilst the remainder and the dust will absorb the extra moisture and store up the richer portions of the manure. Again, the ashes will, after a sojourn in the pig-sty, prove beneficial to all kinds of soil, especially to gardens having a tenacious or clay soil; this will dig easier, work more readily, and grow better crops after being dressed with ashes from the pig-sty.

In some districts store pigs are run on for several months merely for the purpose of consuming the garden and allotment refuse. The cost of so keeping a pig or two is certainly not great, but the profit in pig-keeping, where well carried on, is generally in proportion to the outlay in labour, or money on foods; besides, the general opinion now favours a quick return. This system appears to be particularly applicable to the breeding and fatting of live stock, especially pigs, since so large a proportion of the food goes merely to the up-keep of the pig; so that if we extend the fatting process or the life period of the pig to, say, nine months, when by management and care the pig could be made to attain an equal weight, when six months old, we lose at least one-third more of that food which is required merely to keep the pig alive or enable it to exist. This is a very important point, as in the up-keep of the older pig a rather larger proportion of the food is utilised.

Again, it has been clearly proved that young growing pigs will utilise considerably more of the ingredients of the food on which they are fed than will older and full-grown pigs. The differences are clearly shown in Henry's *Feeds and Feeding*, a book in which much practical knowledge is collected. It is there shown that pigs of about 35 lb. weight required 293 lb. of food for 100 lb. gain, whilst pigs of 78 lb., 128 lb., 174 lb., 226 lb., 271 lb., and 320 lb., needed 400 lb., 437 lb., 482 lb., 498 lb., 511 lb., and 535 lb. respectively to make the same increase. As these are the results of over 500 carefully-conducted trials, it is impossible to over-rate their importance.

The fatting of a pig is thought to be within the power of any-one, provided there be a pig and a sufficiency of suitable food;

but even in this apparently simple process a loss or a profit may result from the various methods followed or from the want of any method. In the good old times of some fifty years ago the killing of a pig at a village farm house was quite an event ; the huge carcase and the many savoury dishes manufactured from the offal were the admiration of the youthful portion of the small community. At this period, well-nigh all the pigs gave up their lives to furnish huge flitches of bacon to adorn the ceilings of the farm houses within a radius of a few miles of the sty where they first saw light. This was prior to the many railways and to the introduction of the mild curing system now in vogue, which renders possible the manufacture of bacon all the year round. In the olden times the pigs were obliged to be very fat, or it would not have been possible to eat the heavily salted bacon which had to be made during four or five months for the whole year's consumption. This also determined to a considerable extent the portion of the year when most of the pigs were fattened. As a rule, the store pigs would be shut up soon after harvest and fed night and morning with as much barley meal as they would eat—no variation of food, and no addition of coal-cinders, earth, roots, being given for some months—the same simple and satisfying fare being given day after day, and continued weeks, if not months, beyond the period when the pig would give anything approaching a fair increase in weight for the food consumed ; but this was a matter which did not appear to trouble our forefathers, who simply followed in the footsteps of their predecessors perhaps for generations in the same farm or on the same estate.

Railways, the mild-curing system, the American hog-raisers, and the vastly more luxurious tastes and habits of the people in the British Isles have changed or are changing all this. We now feed or should feed our pigs all the year round, and from their birth, the early maturing properties of our pigs are being slowly, mayhap too slowly, improved. We study our markets, in which the buyers now require quite a different style and size of fat pig from that of fifty years ago, and we are becoming alive to the fact that a variety of food is even beneficial to a pig. Many pig-feeders have so advanced that they believe in feeding the fatting pigs three times a day, and actually save

the natural heat of the fatting pig by pouring a little hot water on the food during very cold weather, and this at a tithe of the expense which it would cause if the fatting pig had to raise the temperature of the food so that the digestive organs could perform their duties. How frequently in times gone by, if not even now, in some farms and piggeries not up to date, are the poor pigs seen to be shaking and huddling together after having eaten a breakfast of half-frozen mixed food which is supposed to be given to them to convert into meat? Little thought is given to the large proportion of the heat and flesh-forming properties of the food which is needed to render it fit to be converted into pork. Experiments have been carried out in the States which clearly proved that in very cold weather the whole of the sustenance in the cold food was required to warm up the food and to furnish warmth, &c., to enable the pig to live without adding an ounce to its weight. Surely heat can be much more cheaply furnished by the consumption of a small quantity of coal than by causing the pig to burn up its natural heat or fat in making its food fit to perform its duties. It is these little things or small neglects which so frequently cause the fatting and keeping of pigs to be less profitable than would be the case were thought, care, and attention given to the simple task of hog-raising and fatting.

For some years the price of wheat has been so low in proportion to the value of barley and other pig-food that many farmers have fed a large portion of their growth of wheat to their stock; and, so far as can be learned, no farm animal has given a better, or as good, a return for the wheat consumed than has the despised pig. With a great many people the idea of feeding swine on the food of men was distasteful, but sentiment eventually gave way to commonsense, and attempts were made to prove whether or not there was any foundation for the belief that pork made from wheat would be of inferior quality to that made from some other cereals. Experiments were carefully carried out in the United States which clearly proved that the consumption of wheat in the manufacture of pork was a success in every way—a good return was obtained both in the quantity and quality of pork.

This knowledge has been of immense advantage to our American cousins during the last season, and they have largely

adopted the plan of giving at least a portion of wheat to the pigs with their hitherto staple food—maize. The very serious shortage of maize from the 1901 harvest has been tided over with comparative ease by the use of wheat, and so successful has the mixture of maize and wheat proved for pig feeding, that probably many American hog-raisers will continue the plan of mixing the food for their pigs, since the quality of meat is improved, and the losses from broken legs in transit on the cars to the large centres, such as Chicago, are considerably less. Indeed, it is now frankly admitted by pig-feeders in America that the low price of wheat and the scarcity of maize have proved to them a great blessing in disguise. One other step they will have to take ere their pork and bacon takes a high place on the English market: they will have to alter the form and quality of their pigs. Fashion and the desire to produce a very fat pig, or, in other words, a prize-winning and a lard-pig, have together simply ruined the majority of the pigs on the American Continent for producing a side of high-class bacon such as would realise the highest price on the English markets. The change is sure to come, and one of the levers will be the demand on the part of American consumers for such bacon as they can eat, since the well-to-do and middle-classes have become as fond of mild-cured bacon and hams as have the same and even lower classes in this country. The hog-raisers on the other side will very readily alter their system as soon as it becomes evident that there is profit in it. Of course, a few of the monied men and fanciers may still persist in breeding and exhibiting the lard-hog, and there may still be found judges who are interested in, and who will continue to award the prizes to, the obese animals, whose only excuse for their existence is that they can win prizes and honours for their millionaire owners. But most probably we are about to see a great change in the type and character of the fat hog generally produced in the States. Experiments have been carried out which clearly prove that the so-called bacon-hog, *i.e.*, the Large White Yorkshire hog, will not only produce an equal, but a greater quantity of live weight increase on a given quantity of food; and, further, that the proportion of dead to live weight is greater than with the lard-hog similarly fed. Then, as to the value of the meat

per lb., the advantage also rests with the so-called bacon-pig. If all these advantages are totalled, it has been proved that 5 per cent. is saved by feeding the bacon-hog as compared with the thick, short, blocky lard-pig, or as much as will frequently make all the difference between a profit and a loss on the fatting of a lot of pigs when pork is low in price.

It cannot be too forcibly nor too frequently pointed out to pig-keepers that more attention should be paid to the type of pig which they breed and fatten. I well remember the remark of an old customer of mine, that so long as he kept really good pigs only, he could make pork at a profit, but that the fatting of bad-bred pigs almost always resulted in a loss—if not of money of temper. There is little doubt that both pleasure and profit can always be obtained in the breeding and feeding of good pigs.

SANDERS SPENCER.

A CONIFER DISEASE.

Botrytis cinerea, Pers. Syn. Fung. p. 690. (1801).

Syn. *Botrytis Douglasii*, Tubeuf, Beitr. zur Kenntniss der Baumkrankheiten, p. 4. (1888).

This disease was first observed in Germany by Professor Tubeuf (1), attacking the topmost shoots of seedlings, also the tips of the lower branches of older trees of the Douglas fir (*Pseudotsuga Douglasii*, Carr.). The diseased shoots curve downwards or become variously twisted, and the leaves die and separate from the branches, but are frequently prevented from falling, being held in a tuft by a delicate weft of brown cobweb-like mycelium. The author also succeeded in inoculating young shoots of the silver fir (*Abies pectinata*, D.C.), spruce (*Picea excelsa*, Link), and larch (*Larix europæa*, D.C.) with the same disease. It has also been observed on junipers.

Its occurrence has been recorded in Hungary on species of *Abies*, *Picea* and *Larix* by Tuzson (2).

The disease was first observed in this country on seedling Wellingtonias (Fig. 1), the symptoms agreeing in every detail with those described by Tubeuf. It was, however, proved that the fungus causing this disease was not a new species as originally supposed, but the ubiquitous *Botrytis cinerea*, Pers. This determination was corroborated by Behrens (4) and Tuzson (2) and is accepted by Tubeuf.

Two years ago a number of diseased larch seedlings were submitted to Kew for examination during the month of May. These were found to be attacked by the *Botrytis*, whose conidiophores covered the brown but yet hanging leaves of the young shoots, which were much contorted. The young leaves of larch and Scots fir (*Pinus silvestris*, L.) infected with spores obtained from the diseased larch seedlings sent to Kew, turned yellow after four days, and at the expiration of ten days after

infection the terminal portions of the shoots and the leaves were covered with the fruit of the fungus.

A series of experiments proved that the young tender shoots of old trees, as was to be expected, are quite as susceptible to the disease as the shoots of seedlings. The young shoots of old trees growing on branches near to the ground and somewhat shaded, became infected by simply placing spores of the *Botrytis* on the damp young leaves, just as they might be deposited by wind, insects, birds, &c. This method of unprotected inoculation never succeeded when tried on shoots high up on the tree and fully exposed to light and air. On the other hand, when inoculated shoots growing high up on the tree were protected for twenty-four hours by oiled paper, infection occurred as usual, and the disease ran its course. These experiments prove that infection can only take place on a large scale near to the ground, where the requisite amount of moisture is most constantly present, and where the spores of the fungus are also most abundant, as *Botrytis* grows indiscriminately on all kinds of fading and dead forms of plant life, fragments of straw from manure, &c.

Leaves and shoots attacked by the disease eventually fall to the ground, where they remain until the following spring; the mycelium of the fungus present in the tissues having in the meantime given origin to numerous minute black sclerotia or compact masses of mycelium, which are more or less buried in the dead tissues. Just at the time when the young pine leaves are appearing, these sclerotia produce myriads of spores, which are distributed by various agents, and infection of the leaves results.

During the past year a number of diseased larch seedlings, sent from a nursery in the North of England to Kew, showed a very unusual condition of the disease under consideration. The terminal shoots were perfectly free from disease, but the lower part of the stem, from the ground-line for two or three inches upwards, was covered with dense tufts of *Botrytis* (Fig. 2). Many of the seedlings were quite dead and the remainder very nearly so, the leaves having become yellow and shrivelled.

Microscopic examination showed the cortex to be thoroughly permeated with the mycelium of the fungus, which here and

there formed sclerotia embedded in the bark. At a later stage these sclerotia rupture the cortex and appear at the surface bearing a crop of spores (Fig. 3). This form of the disease is by no means uncommon in this country but it does not appear to have been recorded from abroad.

In the first described form of disease, the spores, alighting on the damp surface of quite young leaves or shoots, germinate quickly and the germ-tubes pierce the delicate tissues at once. In the second form of the disease, the germinating spores cannot pierce the bark of a two-year-old seedling directly, but only as a wound parasite, through minute wounds in the bark caused by late frosts, punctures of insects, &c.

When the stem is attacked the plant invariably dies, as the cambium is destroyed by the fungus, and the bark soon forms a loose dead sheath surrounding the wood. When the leaves and shoots are attacked the plant sometimes recovers, but is practically useless, as the leaders are destroyed, and a bushy stunted plant is the result.

It is quite certain that this disease, in one form or another, is much more abundant in our nurseries than is generally suspected. Many of the patches of dead plants in seed-beds, that are usually considered to have been killed by frost or other unfavourable atmospheric conditions, have in reality succumbed to the *Botrytis*, as has been proved by examination.

This is more especially true in those instances where the diseased patch gradually extends from a small starting-point. In other instances the disease will travel along a single row of seedlings for some distance, the closeness of the plants favouring the rapid spread of the disease from one seedling to another.

Preventive Measures.

Perfect cleanliness in the seed-beds is of primary importance. Weeds should not be hoed up and left to die on the ground in the spring, when the leaves of seedlings are quite young, as the *Botrytis* grows on all kinds of dying and dead plants, and the spores pass on to the leaves of the seedlings.

In one instance the fungus causing the disease was found to

spread from stable manure, which had been imperfectly buried in the soil. The projecting portions of straw were thickly covered with the *Botrytis*.

The *Botrytis* is very dependent on moisture and only produces spores in a humid atmosphere, hence it is important that damp, low-lying situations should be avoided for nursery purposes.

When the disease is present, spraying with the following solution, elsewhere called "Violet Mixture," will check its progress :—

Sulphate of copper	2 lb.
Carbonate of copper	3 lb.
Permanganate of potash	3 oz.
Soft soap	½ lb.
Rain water	18 galls.

Every part of the ground within and for some distance beyond the affected patch should be thoroughly wetted. The soft soap should be dissolved in hot water. The remaining ingredients are soluble in cold water.

All diseased seedlings should be collected and burned.

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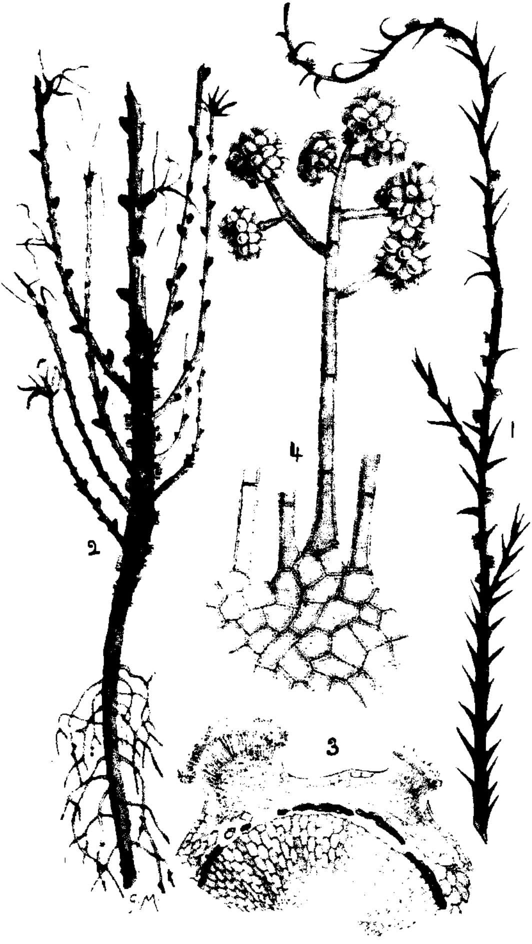

A CONIFER SEEDLING DISEASE

DESCRIPTION OF THE FIGURES.

1. Terminal shoot of a Wellingtonia seedling killed by the *Botrytis*. Clusters of the fungus in a fruiting condition are springing from the dead portion of the shoot. Nat. size.

2. A larch seedling showing stem disease. Numerous tufts of the fungus are attached to the lower portion of the stem. Nat. size.

3. Transverse section through a portion of the stem of a diseased larch seedling. The cortex is seen to be broken up by the mycelium of the *Botrytis*, which has formed two sclerotia that have burst through the bark, and are bearing fruit in the air. Mag. 50 diam.

4. Portion of a sclerotium producing clusters of spores. Mag. 400 diam.

ROT IN SHEEP.

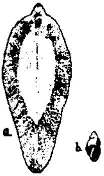

FIG. *a*. ADULT LIVER FLUKE. *b*. WATER SNAIL (*Limnaea truncatula*). Nat. size.

The disease known as Rot, Liver Fluke, Coathe, and Bane, in sheep, has existed in Great Britain for very many years, and has caused greater losses in this country than any other disease affecting this particular class of animal. In a pamphlet written for the Royal Agricultural Society by Professor Simonds in the year 1880, on the subject of the nature, cause, treatment, and prevention of rot, he mentions outbreaks having occurred in the years 1735, '47, '66, '92, and again in 1809, '16, '24, '30, '53, '60, '62, and '79. The outbreak of 1879 continued into the year 1880, and in the statistics prepared by the Board of Trade for 1881 there was a falling off in the number of sheep in Great Britain of no less than three and a half millions compared with that given for 1879. This decrease was reported to be mainly due to the prevalence of rot, the greatest losses having occurred in England, and Scotland being but little affected.

Life History of the Liver Fluke.

The common liver fluke (*Fasciola hepatica*) is found in the biliary passages of the livers of sheep, where it produces many thousands of eggs, which find their way along the bile duct into the intestines and are expelled with the dung. Those which fall upon dry soil may remain dormant for months, but how long they may retain their vitality is not known; whilst those which reach the water in pools and dykes are at once hatched, and a free swimming *ciliated embryo* is produced. This little organism

is provided with a small boring prominence. and as it swims about in the water it searches for a certain species of water snail, to the surface of which it fastens itself, and eventually bores its way into its body. It then becomes the *sporocyst.* The sporocyst grows slowly within the snail, and eventually the germ cells which it contains produce other organisms called *rediæ*, five to eight in number, which eventually escape from the sporocyst and attach themselves to the liver of the snail. Within each redia are formed from 12 to 20 individuals of the next generation, which are known as *cercariae.* These last-named organisms are somewhat similar to the adult parasites into which they eventually develop, their bodies being flat and oval in shape, but they are provided with a tail. After leaving the redia these cercariae pass out of the body of the snail into the water, where they swim about until they attach themselves to a blade of grass or some other object ; subsequently they lose their tail, become encysted—that is, form a case—and remain quiescent until swallowed by the sheep, in whose stomach the wall of the cyst is destroyed. The liberated parasite ultimately finds its way to the liver of the sheep or other animal, and develops into the adult hermaphrodite fluke.

The fluke parasite runs through three reproductive generations namely :—

1st. The sporocyst ;
2nd. The redia ;
3rd. The adult fluke.

There is a gradual increase in the number of the organisms derived from each of these generations. For example, the sporocyst containing germ cells gives rise to several (5 to 8) rediæ, and each redia to a larger number of cercariae (12 to 20), while it has been calculated that each adult fluke may produce the enormous number of 45,000 eggs. But for this remarkable fertility there would be comparatively small chance of the entire cycle of life of the fluke parasite being completed.

Symptoms of Rot in Sheep.

In consequence of the extremely slow development of this disease, the fact that the sheep are affected is scarcely ever

realised until a long time after they have become infected. The symptoms of the disease progress slowly and are characterised by a very gradual sequence of changes, which vary in accordance with the different stages of the disease, and with the health of the animal. In the primary stage, when the flukes are first developed in the bile ducts of the sheep, their presence causes such an amount of irritation to the liver as is sufficient to produce an increased secretion of bile, which in itself has a tendency to aid the digestive process, and as a consequence the animal may feed well and for a time put on flesh. Soon after, as the number of the flukes increases, the liver begins to enlarge, and the bile becomes slightly tinged with blood. At this period the animals fall off in condition and display pallor of the eyes and the gums. The appetite, which was formerly very good, now becomes capricious, and the animal loses strength. As the disease advances the sheep becomes extremely emaciated and weak, dropsical swellings are to be found under the jaws, and the abdomen becomes greatly enlarged ; while the respiration is short, and the liver will be found to have increased in size and to have become very hard. If a *post-mortem* examination be made at this stage the bile ducts within the liver will be seen to be thickened, and their walls when dissected will frequently be found to be calcareous. The bile has a dirty brown colour and abounds with mature and immature flukes and multitudes of ova. When the disease appears among a flock of ewes it is a very common thing for many to abort, and the mortality in a flock may be very high.

Should the sheep survive this stage, which is quite unusual, a period of convalescence sets in of a slow and generally of an unsatisfactory nature. During its progress the flukes are said to leave the liver and pass out in the droppings, but the pathological changes which their long presence has caused within the liver produce emaciation and debility in the animal. The period of time during which these various changes are in progress may be roughly stated as twelve or more months, *i.e.*, from the time of invasion to the time of disappearance of the flukes.

Distribution of the Fluke.

As a general rule rot is confined to the lowlands, marshy

valleys, &c., but it may occur in the high lands. It is also more frequent in wet than in dry seasons, and is most prevalent after prolonged rains in the late summer and autumn. It is often associated with the presence of "carnation grass" and similar sedges, and many farmers look with suspicion on land that carries these plants.

From the preceding sketch of the life history of the fluke it will be evident that the conditions necessary for the propagation of the disease in any district are :—

1. The presence of fluke eggs.
2. Wet, marshy ground or pools suitable for the hatching of the ova.
3. The special snail (*Limnaea truncatula*) to act as intermediate host.
4. The presence of sheep or other animals to swallow the encysted parasite and thus become infected.

Preventive and Remedial Measures.

Sheep ought not to be purchased from a flock reared on fluky ground.

Those sheep which are affected with fluke should be sent to the butcher at once while in a marketable condition, and the others moved on to dry ground.

The livers of the slaughtered sheep should be destroyed, or, if used for dogs' food, they should first be well boiled, as otherwise the fresh eggs may pass uninjured through the intestines of the dog and thus infect the soil.

If rabbits and hares are plentiful on infected ground, they should be kept down, as there is an idea that they may spread the disease; there is no proof, however, that they do so.

If infected animals have been pastured on a given piece of ground, it would be advisable to have the droppings spread by chain-harrowing, so as to assist in drying them, and thus hasten the destruction of the eggs; a little lime would assist this.

Drain if possible.

When practicable, dressing the ground in late summer and autumn with salt alone, or with a mixture of salt and lime, will usually be attended with good results. Sheep should also have

access to lumps of rock salt, and where sheep are getting cake, corn, chaff, and so on, a *little salt* (*¼ oz. per head per day*), mixed with such food should always be provided when fluke is to be feared.

If practicable, it is desirable to place the animals on higher and dryer ground.

Do not overstock the pasture or eat it too bare.

Do not leave the sheep long on the same land.

A most important thing is to cart away at once or cover up with gas lime the mud, reeds, &c., taken from ditches, pools, and ponds when being cleaned out. Numbers of the snails and their eggs, and often the parasites within them, are destroyed when gas lime is put over this rubbish.

Finally :—Whenever rot is suspected in a flock of sheep, sharp observation over the animals will often enable the owner to detect the disease before it has made any serious interference with the health of the majority ; and if, on a *post-mortem* examination of the first suspected cases, flukes are found in the bile ducts of the liver, it becomes an important question to the owner whether it would not be to his interest to slaughter the whole of them at once, while they are in a marketable condition, rather than allow the disease to continue, since by leaving the animals alive they will probably be the means of permanently infecting his pastures.*

* Copies of this article in leaflet form may be obtained, free of charge and post free, on application to the Secretary, Board of Agriculture, 4, Whitehall Place, S.W.

CO-OPERATION IN THE PURCHASE AND TESTING OF MANURES AND FEEDING STUFFS.

Probably the two principal considerations which frequently deter purchasers of fertilisers and feeding stuffs from having samples analysed are expense and a desire not to offend the seller. When small quantities of these articles are purchased the fees for analysing each lot may amount to a considerable proportion of the total cost of the goods. And the strong personal element which enters into the transactions of merchants and farmers, who have maintained for a long series of years business relations which were perhaps established by their fathers and grandfathers, often makes it a difficult and delicate matter for the buyer to do anything which would, however remotely, suggest want of confidence in the seller. But these considerations practically disappear in cases where co-operation for the purchase and testing of manures and feeding stuffs comes into existence. Expense is then reduced to a minimum, because the analysis of one sample is sufficient to test the purchases of all those who have obtained the same article from the same source at the same time. There are in England and Scotland at the present time about fifty or sixty associations which are in some degree co-operative, and which concern themselves with the purchase or testing of manures and feeding stuffs. It is not proposed to describe any of the larger societies, such as the Western Counties Agricultural Co-operative Association, the Lincolnshire Farmers' Association, and the Farmers' Supply Association of Scotland. Such societies, owing to the extent of their operations, and the consequent complication of their organisation, do not afford such clear examples of co-operative work as are furnished by some of the smaller societies. And some of the larger societies are, to some extent, trading associations, working partly with a view to the profit of shareholders.

Of the smaller societies no two seem to be exactly alike in

constitution and methods, but the Perthshire Agricultural Society, the Derwent and District Farmers' Club, and the Central Cornwall Farmers' Association may be taken as types.

The Perthshire Agricultural Society, which has a membership of about 500, exists, like most county societies, principally for the promotion of a show, but it has adopted a simple and efficacious method of protecting its members against fraud or overcharges in the purchase of manures and feeding stuffs. Under the arrangements made by the Perthshire County Council for administering the Fertilisers and Feeding Stuffs Act, purchasers of manures or cattle food can have samples analysed by the agricultural analyst for the county on payment of 5s., the remainder of the analyst's fee being paid by the county. The Perthshire Agricultural Society has arranged that any member may submit samples to the agricultural analyst without payment, the 5s. fee for such samples being charged by the analyst to the society. At the close of the season particulars of the analyses made for members are printed and distributed to members. An extract from one of the tables issued by the society is given on pp. 34–5. From this extract columns giving the date of the invoice, the quantity bought, and the names and addresses of the buyers and sellers, which appear in the original, have been omitted.

The Warwickshire Farmers' Association issues a monthly journal, in which the results of analyses made for members are notified. The information furnished in this way has the advantage of being more up to date than that afforded by an annual publication.

The County Councils of most counties have made very liberal arrangements for the analysis of samples under the Fertilisers and Feeding Stuffs Act. In a large number of districts the fee payable by the purchaser for an analysis by the agricultural analyst is even lower than in Perthshire, and in many counties an official of the Council will attend on request and carry out the formalities required by law in taking a sample under the Act.

The system of the Perthshire Agricultural Society might therefore be followed by agricultural societies in many districts with a minimum of trouble and expense.

The Derwent District Agricultural Club affords a good

example of a slightly different form of co-operation. Several useful purposes are kept in view by this club, but its main object is to afford protection to members in connection with the *purchase of manures and feeding stuffs. Its membership is* about 100. Members occupying over 50 acres pay an annual subscription of 10s. Those occupying less than 50 acres pay 5s., and all expenses of analysis are paid out of the club funds. Members of the club are obliged by their rules to give the club information as to their individual purchases of manures and feeding stuffs. Samples for analysis are selected by lot at the club meetings, which are held monthly. At these meetings the results of previous analyses are read out and discussed.

The following rules are worth quoting :—

(5). "Every member shall use his best endeavour to give such information to the society as shall promote the interests of the society and its private members."

(33). "Any member having made such purchases shall be obliged, if asked, to hand over two fair samples of the article purchased to the club, and the club, if they see fit, shall submit the same for chemical analysis."

These two rules illustrate the manner in which the difficulty above mentioned, *i.e.*, risk of giving offence to the seller, may be to a great extent removed by co-operation. If the club insists on the production of an invoice under Rule 5, or the taking of a sample under Rule 33, the merchant whose goods are sampled cannot make the sampling a personal matter between himself and the member who complies with the rules of the society.

The samples taken by this club are submitted to a private analyst. In the case of a society forwarding samples to the official analyst of the district, Rule 33 would require modification.

The Central Cornwall Farmers' Association, which has about 150 members, exists for the co-operative purchase of manures. The only subscription is a fee of 1s. 6d. per ton on the quantity of manure ordered. This fee is intended to cover the working expenses of the association.

The procedure is as follows :—In November each year a circular letter is sent to the subscribers of the previous year announcing the date of the annual dinner and meeting of the

association, and enclosing a report of analyses of manures, showing the percentages of valuable ingredients guaranteed in the manures purchased through the association and the percentages found by the analyst of the association. At the dinner, money recovered by the association in respect of any deficiencies in the guaranteed constituents of manures purchased by them is paid over to the members concerned.

At the meeting the committee of management for the year is elected, and the committee proceed to decide what manures shall be procured during the coming season and the dates on which the manures shall be delivered.

The committee is rather large, consisting of about thirty-six members, but as the chief work of the committee is to decide what manures shall be purchased, and the wishes of the members of the association may be diverse, a large committee is probably essential to the satisfactory working of the association.

Immediately after the meeting a second circular is sent to the subscribers informing them of the decision of the committee as to the kinds of manures to be procured and the dates of the deliveries, and enclosing an order form, a copy of which is given on the next page.

As soon as the quantities of various kinds of manures required have been approximately ascertained, tenders are invited by advertisement in the Press and by notices addressed to firms who have supplied the association in past years.

The following extract, taken from a recent notice to manure merchants, shows the terms on which purchases are made :—

"The dissolved bones shall contain not less than 20 per cent of soluble phosphate, 13 per cent. of insoluble phosphate and 1½ per cent. of ammonia; such insoluble phosphate and ammonia to be derived from the raw bone used in its manufacture, and 2s. 3d. per unit will be deducted for every unit under 20 per cent. of soluble phosphate, 1s. 1d. for every unit under 13 per cent. of insoluble phosphate, and 12s. for every unit, or 1 per cent. (and so in proportion for any less quantity than a unit) under 1½ per cent. of ammonia.

"The superphosphate to contain 26 per cent. of soluble phosphate, and 2s. 3d. per unit will be deducted for every unit under 26 per cent. soluble.

FORM No. 1.

To the Committee of the Central Cornwall Farmers' Association.

....day of..1901.

Gentlemen,

I request that you will enter my name in your list of Subscribers for Manures as follows:—

To be delivered from 24th Feb. to 15th March at Wadebridge.

..................Tons Ground Bones, ½-inch and dust together
..................*Tons Bone Meal*
..................Tons Dissolved Bone
..................Tons Superphosphate
..................Tons Nitrate of Soda
..................Tons Sulphate of Ammonia
..................Tons Basic Slag

To be delivered from 1st to 24th April, at Wadebridge.

..................Tons Ground Bones, ½-inch and dust together
..................Tons Bone Meal
..................Tons Dissolved Bone
..................Tons Superphosphate
..................Tons Nitrate of Soda

To be delivered from 15th May to the 7th June, at Wadebridge.

..................Tons Ground Bones, ½-inch and dust together
..................Tons Bone Meal
..................Tons Dissolved Bone
..................Tons Superphosphate

I enclose..being the fee of one shilling and sixpence per ton, and

I am, Gentlemen,

Yours truly,

"The nitrate of soda must be 95 per cent. pure nitrate of soda; deductions will be made if not up to this guarantee. The committee reserve the right of separating the nitrate of soda from contract.

"The ground bones to be a genuine sample of pure raw bone ¼-*inch and dust together* guaranteed to contain not less than 45 per cent. of tribasic phosphate of lime, and to yield not less than 4½ per cent. of ammonia, and 1s. 6d. will be deducted for every unit under 45 per cent. of tribasic phosphate, and 12s. for every unit under 4½ per cent. of ammonia (and so in proportion for any less quantity than a unit under 4½ per cent. of ammonia).

"The bone meal to be a genuine sample of pure raw bones, guaranteed to contain not less than 48 per cent. of tribasic phosphate of lime, and to yield not less than 4½ per cent. of ammonia, and 1s. 1d. will be deducted for every unit under 48 per cent. of tribasic phosphate, and 12s. for every unit under 4½ per cent. ammonia (and so in proportion for any less quantity than a unit under 4½ per cent. of ammonia).

"The merchant will be required, at his own expense, to enter into a legal contract (to be approved by the association) to supply the manures in accordance with this circular."

On the arrival of the cargo samples of manure for analysis are taken by an agent of the manufacturer and the agent of the association, and forwarded to the analyst of the association. If the analyses given by him are not satisfactory to the manufacturer, the latter is at liberty to have a further sample analysed at his own expense.

This association has a slight advantage in connection with the sampling of consignments in that their district lies round a seaport, so that their purchases arrive by boat, and can be sampled before distribution takes place. In the case of other similar associations in inland districts, the manufacturers despatch the goods by rail direct to the members, and such associations have to content themselves with sampling a small number of the consignments after delivery to their members.

It is the practice of some associations to cause samples to be taken in the manner required by the Fertilisers and Feeding Stuffs Act, and send them to the official analyst appointed under that Act for their district, but others retain the services of a private analyst. The advantages of sending samples to an official analyst are as follows :—

(1). Samples taken under the Act and submitted to the official

analyst are analysed with special care, in view of the fact that the reports upon such samples are more likely to be made the basis of legal proceedings than reports on samples submitted privately.

(2). In consequence of the responsibility attaching to the analysis of samples under the Act, the fees received by official analysts in respect of such samples are comparatively high, but the proportion of the fee payable by the person or society sending in a sample generally amounts to a very small sum. Therefore, by submitting samples under the Act, the most reliable analyses are obtained at a very small cost.

(3). By submitting samples to the official analyst the society, besides gaining the above advantages for themselves, assists the authorities to carry out the intention of the Act by discovering and dealing with any fraud that may be in existence.

Extract from Table of Analyses issued by the

Nos.	Kind of Manure.	Analysis.		
		Guaranteed.		Obtained.
1	Basic Slag	Insoluble Phosphate... ...	38·00	38·11
2	Do.	Do.	30·00	26·81
3	Superphosphate	Soluble Phosphate	36·00	42·31
4	Do.	Do.	35·00	38·91
5	Kainit	Potash	12·42	12·67
6	Sulphate of Ammonia...	Nitrogen	16·47	19·91
7	Vitrolized Bones ...	Nitrogen	2·27	2·79
		Soluble Phosphate	16·00	12·23
		Insoluble Phosphate... ...	18·00	25·32
8	Nitrate of Soda	Nitrogen	15·64	15·72
9	Potato Manure ...	Nitrogen	7·00	7·67
		Soluble Phosphate	15·00	18·33
		Insoluble Phosphate... ...	3·00	2·26
		Potash	4·50	2·45
10	Sulphate of Potash ...	Potash	16·20	16·55
11	Bone Flour	Nitrogon	1·24	1·05
		Insoluble Phosphate... ...	58·00	72·93
12	Potato Manure ...	Nitrogen	4·11	4·93
		Soluble Phosphate	14·00	18·92
		Insoluble Phosphate... ...	6·00	5·03
		Potash	5·40	5·57
13	Bone Meal	Nitrogen	3·80	3·80
		Insoluble Phosphate... ...	52·00	51·83
14	Turnip Manure ...	Nitrogen	2·00	2·10
		Soluble Phosphate	10·00	15·03
		Insoluble Phosphate... ...	12·00	12·52
		Potash	1·00	2·23
15	Do.	Nitrogen	4·90	4·90
		Soluble Phosphate	15·00	20·11
		Insoluble Phosphate... ...	15·00	12·93
		Potash	1·45	1·55
16	Ground Lime	Caustic Lime	68·00	71·70
17	Nitrate of Soda	Nitrogen	15·64	15·81
18	Peruvian Guano ...	Nitrogen	2·07	'2·45
		Insoluble Phosphate.. ...	69·70	72·41
19	Do.	Nitrogen	6·13	5·70
		Insoluble Phosphate... ...	35·37	35·13
		Potash	3·21	3·13
20	Compound Cake ...	Oil	9·00	8·82
		Albuminoids	24·00	21·63
		Carbohydrates	42·00	39·79
21	Thorley's Cake ...	Oil	7·23	7·58
		Albuminoids	17·43	16·31
		Carbohydrates	52·90	53·42
22	Dried Grains	Oil	—	7·02
		Albuminoids	—	18·81
		Carbohydrates	—	43·48
23	Linseed Cake	Oil	—	9·05
		Albuminoids	—	21·56
		Carbohydrates	—	39·47
24	Miller's Linseed Cake	Oil	Pure	11·50
		Albuminoids	—	33·94
		Carbohydrates	—	32·18
25	Linseed Cake	Oil	95·00	8·10
		Albuminoids	Pure	31·50
		Carbohydrates	—	34·59

Perthshire Agricultural Society (*see p.* 28.

Cash Price Delivered.	CashPrice at Sea Port according to H. & A. Society's Standards.	Remarks.	Nos.
£ s. d.	£ s. d.		
2 7 6	1 18 1	Up to guarantee.	1
2 1 0	1 11 3	Well ground, but deficient in phosphates.	2
3 16 9	3 17 7	Well-dissolved Super. of first-class quality.	3
3 7 9	3 11 4	Fine dry Superphosphate.	4
2 0 0	2 2 3	Dry and in good condition.	5
10 17 6	11 12 0	Ordinary good quality.	6
4 16 6	5 1 9	Dry and in good sowable condition. Soluble phosphate is deficient, and there is a corresponding excess of insoluble phosphate.	7
8 10 0	8 15 6	Moderately dry, and is up to guarantee.	8
7 10 0	6 8 9	Dry and in very good condition.	9
2 17 6	3 2 0	Good condition, and up to guarantee.	10
3 17 6	4 10 7	Very dry and powdery, and in fine mechanical condition. The phosphates are so much over guarantee as to suggest that the guarantee was nominal—there is about a fifth of a percentage of a deficiency in nitrogen.	11
5 7 6	5 13 4	Dry and in very good mechanical condition. A slight deficiency in insoluble phosphate is more than counterbalanced by excess of other ingredients over guarantee.	12
4 18 9	4 18 0	Good sample, equally ground, and up to guarantee.	13
5 17 6	3 12 8	Very good mechanical condition, in excess of guarantee.	14
6 0 0	5 10 0	Very fine mechanical condition. The apparent deficiency of insoluble phosphate is due to the considerable excess of soluble. The total phosphate is above the total guarantee. The manure therefore must be considered as fully beyond guarantee.	15
1 2 0	—	In good condition, and up to guarantee.	16
8 12 6	8 16 6	Up to guarantee.	17
5 17 6	6 13 6	In fine sowable condition, and well up to guarantee.	18
7 12 6	7 16 8	Of good quality. Contains less than an average amount of sand.	19
6 10 0	—	Fresh and in good condition, but shows a slight deficiency all over in the analysis.	20
7 10 0	—	Fresh and in good condition.	21
5 0 0	—		22
8 5 0	—	Contains an unusually high percentage of starchy material. It is not over 90 per cent. purity.	23
8 10 0	—	Fresh and in good condition. It is of 98 per cent. purity.	24
8 5 0	—	In good condition, and is of 95 per cent. purity.	25

RECENT FEATURES IN ARGENTINA'S AGRICULTURAL PROGRESS.

The Argentine *estanciero* has some reason to reflect upon the sweet usefulness of adversity. It was the crisis of 1890 that drove him from dreams of speculation "back to the land." It was the lack of capital that induced him to call in the colonist to convert his rough western lands into alfalfa paddocks, and by making agriculture his handmaiden to become, perhaps unconsciously, a contributor to Argentina's production of wheat, maize and linseed. It was the outbreak of foot-and-mouth disease among his herds, and the resultant closure of the British ports to his live stock, that forced upon him the profitableness of the cow for dairy produce. However related these developments may be to the ordinary sequence of progress, they seem to have assumed their most vigorous manifestation when events appeared least propitious to their encouragement.

At the present time, more than an ordinary interest has arisen in the pastoral resources of the country. The increasing local demand in the United States, which has already outstripped its meat production if the imports of live stores from Canada and Mexico are charged to the debit side; the lamentable drought in Australia; and the augmented consumption of meat per unit of population in the United Kingdom, combine to attract the attention of this country to Argentina as a source of supply. At such a time a brief review of the stage of agricultural production at which Argentina has arrived is not inopportune.

It is perhaps worthy of note that the neighbouring republic of Uruguay, whose present capital of live stock is twenty-eight million sheep and six million cattle, cannot fail to become an important supplier of food-stuffs for Europe in the near future. The sheep stock is at present chiefly merino, and the cattle are

bred more with an eye to the jerked-beef trade with Brazil than to that of the home meat market. The lack of freezing factories, occasioned by the want of a port with adequate shipping facilities, limits the Uruguayan pastoral output to its annual parcel of merino wool, and the shipment of salt *charqui* to Brazil. But these conditions will not remain for long unchanged, and the arrival of Uruguayan frozen and chilled meat may be looked for at a not distant date as a new contribution to the home market.

A question frequently put to the Argentine stock raiser is:—Do you expect your capital of live stock to increase?

It is probable that the sheep stock in Argentina has reached its maximum number. This is usually stated at 120 millions, an estimate which must be accepted with some distrust until the approaching census confirms it. The bulk of Argentine sheep are Lincoln cross-breds, and the wool produced by this type of sheep is that which has suffered most in the drop in values dating from 1899. When the British ports were closed to Argentine live stock, the demand for large-framed wethers fell away; the freezers required a medium-sized carcase, and paid no more for the heavier sort. To reduce the change to figures:—In 1898 a good cross sheep gave a fleece worth 4s., and the butcher value of the wether was 12s.; in 1901 the same fleece was worth 2s. to 2s. 6d., and the same wether sold for 8s. Sheep breeders were discouraged; they saw better prospects in cattle, and in the zone surrounding the city of Buenos Aires the sheep has given place to the cow. With an increasing demand for land for agricultural purposes, and the inception of the dairy trade, it is not likely that sheep will regain much foothold in the districts where they have been displaced. It may be alleged that in other regions, such as the extreme south of Patagonia, the sheep stock will increase, but not sufficiently so to more than compensate for the reduction in flocks elsewhere.

This statement does not imply that the export of mutton carcases from Argentina will not exceed the record of 1902, viz., 3,600,000 head. Argentine husbandry is improving, and a better return of butcher stock upon the capital may be expected. A comparison between the export of mutton from New Zealand and Argentina, in relation to the total number of sheep in each

of these two countries, and their local consumption, will satisfy the British consumer that the latter is making as yet a small call upon her resources in the amount of mutton she exports for sale.

Frozen lamb is a new item in the Argentine meat trade. It is going to become one of large proportions. It is strange that this article of export has delayed so long in becoming a feature of the trade. Freezers say that breeders could not produce a lamb suitable for export; breeders say that the freezers offered them no encouragement to do so. There is some truth in both statements, but the supply has proved to be ready at the first beck of demand.

The cattle stock of Argentina has been estimated recently at 28,000,000. Until the census confirms this estimate the odd 8,000,000 might be discounted. Even upon this more modest estimate the export figures for 1902 of 830,000 chilled quarters and 27,000 head live steers (exclusive of jerked beef) is a paltry dividend. Yet 1902 is a record year for Argentina in the export of fresh beef, and far exceeds the best output when the British ports were open.

Two years ago, when the freezing factories enlarged their premises to provide for the new trade of chilled beef, the question asked in Argentina was not whether they could handle the quantity of good quality steers offered to them, but whether the breeders could supply them with sufficient good quality steers to keep them busy.

The question was one of quality not numbers. Until the United Kingdom became a consumer of Argentine beef, first lairage-killed, and, at a later date, chilled, there was no incentive to the ordinary breeder to improve the quality of his cattle. The man of foresight understood the economy of his craft, and introduced good blood to his herd; but it was only when the new buyer, the British consumer, appeared on the scene, and explained that unless he got the right quality he would have none, that the *estanciero* bestirred himself. When he found that he had the choice of two markets, his old Brazilian friend, the eater of jerked beef, offering him £3 10s. for his flat-ribbed, thick-hided five-year-old bullock, and the British beefeater willing to pay £7 for a shiney-coated, well-covered steer a year younger, he understood "where the sunshine was warmest," and set forth to im-

prove his herds. The extensive purchases made in England of pure pedigree stock for the Argentine are too well known to require comment. Their blood is being diffused through the general herds of the country, and each year brings an increasing crop of "export-type" cross-breds.

Such changes are not effected in two or three years. Upgrading from rough cattle by crossing with approximately pure Shorthorn or Hereford bulls must continue through at least three generations before the requisite quality for export is obtained. Breeders cannot always afford to buy "pure" bulls, and in using cheaper ones the process of upgrading is slower. It was difficult in 1895 to gather 40,000 steers in all Argentina of sufficient quality and finish to suit the British market. In 1902 the output was a quarter of a million. Even so, bullocks of this type are drawn from the front rank only of the Argentine herds. But the upgrading goes on with increasing rapidity. It is certain that Argentina's export of fresh beef will leap up yearly, and the cause will not be the increase in the total capital of horned stock, but the improved quality of the stock.

At the Live Stock Show, held by the Argentine Rural Society in September last, over 1,000 pure Shorthorn bulls were sold at an average price of £120. From one herd alone twenty-four bulls obtained an average price of £340. These figures indicate the seriousness with which the stock breeder is preparing himself to supply the meat market.

Forecasts are dangerous, but it is not unreasonable to state that by the end of the present decade Argentina will be able to export for European consumption, either chilled or frozen or on the hoof, 10,000,000 cwt. of beef and 5,000,000 cwt. of mutton per annum.

Before leaving the subject of Argentina's meat production, a few words on the effect of the three years' closure of the British ports to the live stock of River Plate origin will not be out of place. It may be frankly said that the outbreak of foot-and-mouth disease in Argentina, requiring on the part of the British Government the application of the Contagious Diseases of Animals Act, has been a blessing in disguise. It has led to the expansion of the freezing trade, to the inception of the chilled meat trade, and has been a contributor to the establishment of

the dairy trade. Existing freezing factories have been enlarged, new ones have been or are about to be made, and capital has gone out to the River Plate to be engaged in all the sections connected with the economical handling of animal food-stuffs. There is no occasion in this place to discuss the respective merits of dead meat and meat exported on the hoof. But what is of importance to Argentina, and of considerable interest to the British consumer, is that the capital introduced to the River Plate connected with the dead meat and allied trades has gone there to stay, and is not only the factor by which the output of food from that country is going to be very largely increased, but it will find a sufficient supply at the South American end to justify the enterprise of those who have so employed it.

Another not less important feature derived from the experience gained by the recent epizootic outbreak is the improved system under which stock intended for the foreign market is inspected and provision made for its shipment under the best sanitary conditions. Live stock is officially inspected both on the *estancia* from which it is sold for export and again on arrival at the port of shipment, and again when it is embarked. Any outbreak of disease, or symptoms suggesting that the live stock of a farm is in an unhealthy condition, or deaths which cannot be traced to an ordinary cause, are at once reported to the nearest municipal authority, and thence to the Live Stock Department of the Ministry of Agriculture. These, and other regulations derived from the new Argentine live stock sanitary law, have served to spread a better knowledge of the state of the country's herds and flocks, and the object-lesson they provide for the breeder impels him to take a keener interest in the welfare of his animals, and to study not only their health, but the other conditions in which they are reared, with an increasingly competent knowledge of the economy of his business.

It is already known that in the zone lying to the north-west of Buenos Aires the inferiority and sparsity of the indigenous grasses led to the cultivation of the land for three to five years with crops of wheat, maize, and linseed, and thereafter laying it down permanently in lucerne for cattle raising.

The alfalfa zone now includes not only the rich loam of the Province of Santa Fé, but has pushed south and west from there

into the lighter and sandier soils of Cordoba, the north Central Pampa, and the Province of Buenos Aires. Here the same process of triennial agriculture continues, and the "alfalfa country" extends its limits yearly. The cost of laying down new land in alfalfa has decreased. Seed is cheaper, cultivation is cheaper, and its methods are improved. Landowners are making alfalfa paddocks on a larger scale. There are three *estancieros* in Cordoba who have combined forces and are laying down 400,000 acres in alfalfa this year.

Alfalfa is better adapted for cattle than for sheep. The latter can be run under cattle, but more than one sheep to one and a-half acres is not prudent if the plant of lucerne is not to be eaten out. In addition to this, every three acres can support a cow and her calf comfortably, and still leave an ample corner whereon to graze for the butcher. Cattle develop rapidly on alfalfa, and steers bred and fattened on it kick the beam at ninety stone before they count four summers. Sheep bred on alfalfa are more useful for mutton than for wool. Indeed, the alfalfa *estanciero* must be essentially a producer of meat, so far as he employs his plant for stock raising.

When alfalfa obtains a strong hold of the land it monopolises all the room ; other grasses do not thrive if mixed in with it. Upon a congenial soil it grows vigorously, and is most tenacious where the water supply is at a considerable depth below the surface. The depth to which this plant will strike in search of moisture and the thickness of root it develops in the process has not escaped the attention of those who delight in the marvels of nature. The statement, however, of an artesian well-borer, that the obstacle blunting his drill at a depth of 500 feet proved to be the tap root of an alfalfa plant also engaged in plumbing for water, has not been confirmed.

It has been remarked that agriculture in the Argentine chiefly owes its spread to the demand for the nomadic "colonist," who tills the soil for three or more years on a crop-share rental system, and thereafter, having sown the alfalfa seed, leaves again in search of other land. It has been suggested in consequence that the agricultural production is only an incidental feature, and that when all the land suitable for lucerne has been laid down in that pasturage the agriculturist will find himself

without an occupation. Such being the case, Argentina could not be regarded as a permanent exporter of cereals. Nothing of the sort is likely to occur, and the following are, briefly, the salient reasons.

Though alfalfa is entitled to be called a permanent plant, experience has already proved that the *estanciero's* work is not finished when his alfalfa paddocks are made, and that nothing remains but to graze his beeves thereon for ever. After a series of years the plant grows thin in the upper lands, or knolls—if such a term may be applied to the undulating irregularities of the pampa—and either from a period of drought or from injudicious stocking, the alfalfa becomes patchy. The *estanciero* finds it necessary to re-sow his land, treating it in sections as occasion requires, and the increased rent he can obtain from the agriculturist for land which has already been tilled and subsequently grazed encourages him to do so. There are few alfalfa *estancias* where agriculture on a small or large scale is not a permanent feature.

There are numerous colonies where the land, divided into small farm lots, is owned by the agriculturist. There would be more if the Italian ploughman, to which nationality the bulk of the agricultural community belong, showed more ambition to settle down and farm his own land.

In some provinces, such as that of Entre Rios, agriculture is not an intermediate stage between indigenous grass lands and alfalfa paddocks. It is practised there for its own merits as the best revenue producer for the landowner. In a great part of the southern zone of the province of Buenos Aires agriculture is also a permanent industry.

The need of "clean land" for weaners, the growth of the dairy trade, the increased value of land and the necessity to get more out of it, are all making for the introduction of mixed farming in the rich lands surrounding the city of Buenos Aires.

It may, therefore, be stated broadly that agriculture is not likely to lose foothold in any of the ground it has gained, and as it continues to push west, north, and south, its available area will continue to increase.

There were some twelve million acres in wheat and linseed last year in the whole Republic, and a large new area of land

will go into cultivation this season. The virgin area still available for agriculture is vast, though it is doubtful if in the far west and south, where the water lies at a greater depth and is frequently brackish, and the rainfall is scant, the cultivation of cereals would be successful without irrigation. But it would be hazardous at the present time to draw the limits of the wheat-growing area, and while so much good useful soil still remains untouched, the spread of agriculture depends not upon the natural resources of the country but upon the arrival of labour to turn them to account.

What has most contributed to the spread of agriculture in the Argentine is railway enterprise. With trifling exceptions, all the railways in that country are owned by British companies. However much their willingness to extend their branches has been gratified by results, the fact remains that Argentina might still be an importer of wheat had not foreign capital enabled her to turn her lands to account. It is, perhaps, fortunate for her development that her railways are owned and managed by public companies and not by the State. Throughout the agricultural zone new branches are being made, carrying the colonist and the tools of his craft to virgin lands and putting him in touch with his buying market. Every lineal mile of new railway calls fifteen thousand acres of land into cultivation.

Fifteen years ago the traveller in Argentina would arrive at an *estancia* where the mobs of cattle numbered thousands, to find that he had to drink tea without milk, and mark as a token of honour to the guest a tin of Danish salt butter on the table. The dairy supply of the great city of Buenos Aires was in the hands of Basques, who milked their cows in unclean yards, and rode off in the morning astride a jangling pannier of tin cans, the cream churning into butter as the horse trotted through the lanes of the suburbs. Thus they cantered into town to dispense their wares from door to door, and their sole competitor was the pedestrian cow-herd, who drove his kine through the busiest streets, and, in answer to the hail of the housewife, supplied milk "fresh from the cow." The process of churning by equitation demanded the roughest of trots, and the cowboy of Argentina describes the rude gait associated with this interesting function as a "*trote lechero*," a milkman's trot.

Men who are still young have seen a horse-hide vessel containing cream secured to a rough sled and dragged at break-neck speed over the Pampa. When the wild chase ended and the hide vessel was opened, butter was revealed.

A few years ago a leading *estanciero* took up the trade of the dairy supply of Buenos Aires. He erected buildings on his estate and equipped them with separators, refrigerators, and all the most modern appliances of dairy science; introduced milking herds, of which the Dutch Holstein and the Shorthorn were the predominant breeds; opened numerous supply stores in the city, whose cool, white-tiled rooms speedily became popular with the man in the street; and in a year the Basque with his clattering cans and the street cow had faded into the past.

This was the beginning of the dairy trade. The drop in wool values, particularly in the strong cross-breds which constitute the bulk of the Argentine wool parcel, induced live stock breeders to give more attention to their herds of cattle. The outbreak of foot-and-mouth disease, and its effect on the live stock trade, was a further incentive to the *estanciero* to study the profitableness of the dairy business. Central butter factories, receiving cream either by direct purchase or on the co-operative system, were established in many districts. In 1898, the production of butter barely exceeded the local consumption. In 1902, over 4,000 tons were exported, almost entirely to the United Kingdom. The importance of producing a uniform quality has made the farm dairy and churn give place to the central factory, and the result has been a corresponding improvement in the market value. In 1900, Argentine butter was sold at a price inferior to that obtained for the French, Dutch, Danish, Swedish, and Australasian article; to-day, Argentine butter obtains a price second only to that of Denmark and Sweden.

At the present time the cows are entirely grass-fed on the natural pasturage of the *estancia*. The calf is kept at foot and not weaned. From forty to fifty cows are allotted to each dairy hand. The average return per cow is estimated at 262 gallons of milk per annum, though that figure is one which may be expected to increase as the dairyman proceeds to throw out the poor milkers from his herd and gets more conversant with the

art of breeding for the dairy. The return of butter fat is usually 4 per cent. Upon one *estancia* alone there are eight thousand cows milked daily, a number which probably constitutes the world's record.

What becomes of the skim? It is usually thrown away. The Argentine breeder knows all about pigs and the allied industries of the dairy trade, but the time is not yet ripe for their introduction. The *estanciero* is waiting for the pig man to come, and there are few things more certain than that within a decade Argentina will be second only to the United States of America in the export of bacon, ham, and dairy bye-products.

The awakening of the dairy trade in Argentina promises to introduce new phases to the rural industries of that country. Mixed farming will be substituted for grass-feeding live stock, and agriculture in certain zones will become a permanent feature of the new *estancia*. The rotation of crops, the use of manures, the whole economy of the farm will be evolved from the present homely practice of milking grass-fed cows, separating the cream, and throwing the skim away. Agricultural production will become more intense, and when it is remembered that anywhere within a two hundred mile radius of the city of Buenos Aires, the soil, climate, and rainfall are suitable for every branch of rural trade, from bee-keeping and jam making to breeding prime steers for the European market, the success awaiting these steps in agricultural industry ceases to be conjectural.

HERBERT GIBSON,

Vice-President of the Argentine Rural Society.

LARGE AND SMALL FARMS IN PRUSSIA.

At the instigation of the "Verein für Sozialpolitik," the Prussian Chamber of Agriculture has been induced to conduct an inquiry into the economical advantages and disadvantages of large, medium-sized, and small farms; and a recent volume of the *Landwirtschaftliche Jahrbücher* (Band XXXI., Ergänzungsband I.) is devoted to a compilation by Dr. E. Stumpfe of the material collected. Of this compilation, the following article is a brief abstract, containing only those features of the inquiry which are of interest to British agriculturists.

The following table, giving the size of German farms in 1895, shows that the subject is of great importance in that country :—

Size of Farms.	Number of Farms.	Aggregate area in acres.	Per cent. of Total Agricultural Area of Germany.
Under 5 acres ...	3,235,169	4,465,000	5·56
5 to 12½ " ...	1,016,239	8,116,000	10·11
12½ to 50 " ...	998,701	24,011,000	29·90
50 to 250 " ...	281,734	24,375,000	30·35
Exceeding 250 " ...	25,057	19,337,000	24·08
TOTAL ...	5,556,900	80,304,000	100·

Stumpfe points out that "large *v.* small farms" has been a subject of controversy in Germany for at least two centuries.

It is necessary in the first place to say a few words about the material used as the basis of the investigation. The whole of the data were obtained directly from the farmers by representatives of the Chambers of Agriculture of the respective provinces, and practically all of it originates from one or other of the following six Prussian provinces:—Saxony, Brandenburg, Silesia, Posen, West Prussia, and Pomerania. As was to be anticipated in such an inquiry, some difficulty was experienced in finding

farmers willing and able to give the desired information. In all, the requisite data, consisting principally of a detailed account for the financial year 1896–97 of the income and expenditure, number of labourers employed, wages paid, area and yield of each crop grown, number and kind of live stock kept, together with the returns from the same, were obtained from 63 farms, of which Stumpfe describes 22 as "large," 24 as "medium-sized," and 17 as "small."*

As the object of the inquiry was a comparison, from an economic aspect, of various-sized farms, it was necessary to ensure, as far as possible, that the only difference in a series of farms which were being compared with each other was in their size. Great care has been taken to exclude all doubtful cases, and comparison has only been made in the case of farms reported by the same enumerator—as some of the desired factors were not included in the farm accounts and had therefore to be estimated by the enumerator—to be on land of a similar character, in an equally high state of cultivation, situate in the same district, and on which the same system of farming is adopted, &c., &c.; in fact, *of a series of farms under comparison, size is, as far as practicable, the one variable factor.*

For the sake of uniformity the author has considered it desirable to slightly alter several of the data obtained from the farmers. The charges made on farms of approximately equal size by the farmers themselves for their own work and that of their families vary enormously; but the Chamber has estimated these services at the salaries of sufficient, but not more than sufficient, persons qualified to do the work. Thus the farmer's services are valued at the salary of an intelligent working man, farm-manager, or bailiff, according to the requirements of the farm; similarly, in the case of three daughters at home, all helping slightly with the work, the farm is not necessarily charged with the value of the services of three able-bodied women, but probably with the salary of only one such suitable person.

* Roughly speaking, "small" farms comprise those under 25 acres; "medium-sized" those between 25 and 250; and "large" those above 250 acres. In addition to the extent, however, the value of the holding per unit of area, the intensity of the farming adopted, and relative amount of labour employed, have been taken as guides in determining to which of the three classes the various farms were to be assigned.

In the case of the 63 farms described in the report, the net profit per unit of area (excess, per unit of area, of income over expenditure) has been calculated, and this has been adopted as a criterion of the most suitable size of farm. The farms of 25–250 acres have yielded a net profit equivalent to approximately 21s. 6d. per acre; next come farms of under 25 acres with 19s. 4d.; and, lastly, farms of over 250 acres, on which the net profit is equivalent to only 14s. 6d. per acre. There has thus been comparatively little difference in the return from farms under 250 acres; above this, however, the returns show a distinct falling off. The slightly decreased returns from farms under 25 acres, as compared with those of from 25 to 250 acres, is attributed, not directly to the small size of the farm, but to the comparatively large number of hands engaged on such farms—there is often insufficient work to fully occupy the farmer's family.

A calculation of the interest obtained on capital shows the three sizes of farms in the same order, thus: farms of 25–250 acres returned approximately 3 per cent., farms under 25 acres approximately 2·6 per cent., and farms over 250 acres only about 2·2 per cent. All the farmers on the 63 farms described are also owners of the farm, and the capital on which the interest has been calculated includes—to use English terms—both landlords' and tenants' capital. As the farms have in each case been charged with the actual value to the farm of the services of the farmer and his family, the interest obtained represents the financial results of money invested in farming. Although a few solitary farms have returned a very satisfactory interest on capital (one, the best, a highly-farmed farm of approximately 300 acres, having given a return of 6·5 per cent.), none of the three classes of farms—large, medium-sized, or small—has returned what may be regarded as a fair rent; in fact, had these farmers been in the position of tenants, the majority of them would be farming at a distinct loss. The profits stated on page 49 have suffered no deduction for rent; they are the combined profits of owner and occupier. This report would indicate, then, that farming in Prussia is not more remunerative than farming in England.

Interesting, though, as the author says, not new, are the

results of a comparison of the profits obtained on good and on poor land. In the case of both large and smaller farms, good land gives a much greater interest on capital than does poor. Thus, to take the large farms as an example, nine holdings of poor land gave on the average only 1·83 per cent. interest on the capital invested on them, whereas the average interest obtained on four very highly-farmed holdings of rich land was 4·37 per cent., one of these, mentioned above, returning 6·5 per cent. interest.

A comparison of the number of hands (men, women, and children) employed on large and small farms, and of the financial results accruing from their labours, brings to light some very interesting facts. Selecting the first two large and two small farms described for the Province of Saxony (the case is the same for the other farms), the following table supplies the data necessary for our comparison :—

	Number of hands employed.	Area in acres.	Total capital invested in farms. £ s. d.	Total profit obtained. £ s. d.
Average of 2 large farms.	62½	1,385	31,831 16 0	866 11 0
Ditto 2 small ditto.	4½	20	613 11 0	17 9 0

Taking approximate figures, one hand is employed on every 22 acres on the large farms and one to every 4½ acres on the small farms. On the large farms each hand produced a profit of £13 19s.; on the small farms, however, a profit of only £4 2s. Each hand has thus produced nearly 3½ times as much profit on the large farms; but for each hand employed there is rather more than 3½ times as much capital invested in the large farms. Small holdings would thus appear to afford an excellent means of finding occupation for the inhabitants of a country; the return per man, however—which fairly represents the value of a man to his country—is very insignificant compared with that produced on large farms. On the very small farms there appears to be an absolute waste of energy.

The following table* shows the increase in the use of the reaping-machine in Germany during the last twelve years:—

Percentage of farms on which the reaping-machine was used.	Farms of 12½–50 acres.	Farms of 50–125 acres.	Farms of 125–250 acres.	Farms of 250–1,250 acres.	Farms of more than 1,250 acres.
In 1882	0·2	2·7	10·3	27·9	36·5
In 1894-5	0·7	5·6	14·5	30·8	36·7
Increase during the 12 intervening years ...	0·5	2·9	4·2	2·9	0·2

From this table it is evident that the reaping-machine is used on but a small proportion of the farms, and that its use, even on the large farms, is not increasing to any appreciable extent. In the year 1894-95 it was still used on less than one-third of the farms of 25–1,250 acres. Statistics are also given showing a similar state of affairs in the case of steam-threshers, corn-drills, and manure-distributors. Thus, in 1894-95, on only 56·7 per cent. of the farms of 250–1,250 acres was a steam-thresher used.

The reason advanced to explain the small extent to which machines are used is the relative prices of implements and of manual labour; the present writer can bear testimony that agricultural implements (doubtless on account of the high import duties) are much more expensive, often costing two to three times more in Germany than in England. It appears, further, that those farms which have a reaping-machine only use it for a very small proportion of their corn, *i.e.*, only use it when sufficient manual labour is not obtainable. Many of the machines, *e.g.*, drill-machines, manure-distributors, are used, despite the greater expense, because of the impossibility of obtaining labourers with the intelligence, skill and experience required to do the work properly.

From a recent article by Brössling† on the wages obtained by farm-servants in the province of Silesia, based on returns from

* From "Die Deutsche Volkswirthschaft am Schlusse des 19. Jahrhunderts. Bearbeitet in Kaiserl. Stat. Amt., Berlin, 1900."

† Die Lage der Landwirthschaftlichen Arbeiter in Schlesien am Ende des 19 Jahrhunderts.

483 farms and comprising 20,000 workpeople, a table is extracted showing that the average wages of a hind in Silesia amount to £20 7s. in money, and kind to the value of £5. As, according to Brössling, the average earnings of the hind's wife are £5 10s., and that of the children of the family £2 10s. to £5, the total income of the hind and his family, including the value of the kind, is £32–£42.

The Chamber of Agriculture's comparison shows that a much larger proportion of the wages is paid in kind on small than on large farms. The following, which is an account of the annual wages of the foreman (" Hofmeister ") on a large farm of 2,050 acres, illustrates the variety and value of kind paid: Cash, £9; corn, value £11 10s.; 2 sheep, value 30s.; 2 litres of milk daily, value 58s.; peat fuel, value 15s.; potato-land and manure, value £4 10s.; wood, value 15s.; butter, value 52s.; straw, value 3s.; and house, value £3. In this particular case of a total wage value £33 13s., only £9—less than one-third—is paid in cash; and the result of Brössling's researches in Silesia showed that on the average from half to two-thirds of the wages of farm-servants in that province are paid in kind.

According to Conrad,* the exceedingly low wages of the farm-servants in Germany are in a very large measure due to the fact that most of them are themselves farmers—owners and occupiers—of small holdings. In Germany, as will be seen from the first table in this article, there are more than three million holdings of under 5 acres. Their own holding neither fully occupies their time nor yet returns enough to maintain them, and they must therefore have other work; and, further, and this is the important point, work in close proximity to their own holdings. The result is that they are compelled to work for the neighbouring large farmer at practically whatever wage he chooses to offer.

Other points brought to light or confirmed by the inquiry are that on small farms :—

1. There is less depreciation and risk on horses. This is because on small farms the horses are fed, groomed, and worked by their owner. The usual allowance for depreciation and risk

* Grundriss zum Studium der politischen Oekonomie, Jena, 1902.

on horses is 8 per cent. on "small," 10 per cent. on "medium-sized," and 12 per cent. on "large" farms.

2. There are fewer repairs of implements and less depreciation. The reason given for this is that more care is taken of the implements, and that machines requiring expensive repairs, *e.g.*, drill-machines, are absent. The usual allowance for depreciation and repairs of implements is 10 per cent. on "small," 12 per cent. on "medium-sized," and 15 per cent. on "large" farms.

3. Stock "do" better. Here we have a confirmation of the old adage to the effect that the master's eye feedeth his cattle. Further, there is relatively much more stock, particularly pigs, kept on small farms.

4. The saleable value of land is much greater (about 30 per cent.) when in small holdings than when in one large farm. The explanation given is that there are more purchasers with the requisite amount of capital, and probably that small holdings return a slightly larger interest on capital than do large farms.

GEORGE POTTS.

AGRICULTURAL AND MISCELLANEOUS NOTES.

Experiments in the Growth of Oats.

Investigations have been conducted by the Yorkshire College on the comparative weight and percentage of husk in varieties of oats, and also on the effect of growing black and white oats in mixture. These experiments have now been spread over three years, and the results up to 1902 may be summarised as follows :—

The comparative weights of varieties of oats are obtained by taking from the bulk of saleable corn, exclusive of light or second corn, samples of each variety containing a definite number of grains and carefully weighing them. Fourteen distinct varieties of oats have been so treated, and their weights in each of the three years are shewn below :—

I.—Comparative Weight of 2,000 Grains of 14 Varieties of Oats.

Name of Variety.	1900.	1901.	1902.	Average.
	* Grams.	Grams.	Grams.	Grams.
† Storm King	—	—	91·9	91·9
† Tartar King	67·6	84·6	71·9	74·7
† Abundance	75·1	73·2	72·9	73·7
† Newmarket	73·0	73·6	73·2	73·3
† Goldfinder	—	69·6	66·0	67·8
† Pioneer	68·0	65·3	66·0	66·4
† Waverley	69·6	65·5	62·2	65·8
‡ Banner	—	—	62·0	62·0
§ Black Tartarian	57·0	57·8	59·2	58·0
‡ Golden Giant	57·8	58·1	57·7	57·9
§ Potato	56·9	51·9	57·0	55·3
§ Hamilton	54·6	50·6	55·8	53·7
§ Longhoughton	57·7	49·1	52·4	53·1
§ Sandy	57·0	47·5	47·0	50·5

* 28·35 grams. = 1 ounce.
† New varieties.
‡ Canadian varieties.
§ Varieties which have been long in use in Britain.

An examination of this table will indicate the following points :—

1. The average column not only gives the relative weight of a single grain, but within reasonable limits indicates the relative size.

2. The new varieties are the heaviest and therefore the largest. This indicates the result of selection and hybridisation of recent years.

3. The influence of the season on the grain is seen by comparing the weights of each variety for the three years. Some are hardly affected, others show great variation.

4. If the seed is sown by weight, since it will take nearly twice the number of seeds from the Sandy variety to produce the same weight as those from the Storm King variety, a plot of the latter will only contain about half as many plants as a plot of the former, provided the germinating power is the same in each case. Hence the last column, if taken in the inverse ratio, will give the relative number of plants on each plot.

The percentage of husk in a sample of oats is influenced by the variety as well as the season in which it is grown.

In a wet season, inasmuch as the kernels are generally larger and more uniform, the percentage of husk is smaller.

The average weight of husk on 200 grains during these three years was as follows:—1900 = 1·82 grams., 1901 = 1·827 grams., 1902, a wet season, = 1·573 grams.

The table below shows the percentage of husk in the fourteen varieties of oats during the seasons 1900–1902:—

II.—THE PERCENTAGE OF HUSK IN OATS.

Name of Variety.	1900.	1901.	1902.	Average.
Goldfinder	—	25·94	23·04	24·49
Abundance	24·38	26·35	24·92	25·22
Newmarket	24·79	26·68	24·89	25·45
Banner	—	—	25·57	25·57
Waverley...	26·72	26·82	25·05	26·20
Sandy	27·54	29·71	22·21	26·49
Longhoughton	29·29	28·63	22·90	26·94
Hamilton...	28·39	29·65	23·35	27·13
Potato	29·30	29·35	22·98	27·21
Golden Giant	30·10	28·98	24·42	27·83
Black Tartarian	29·66	30·22	28·11	29·33
Tartar King	31·95	33·92	29·96	31·94
Storm King	—	—	32·21	32·21
Pioneer	36·18	35·71	31·33	34·40

An examination of this table will indicate the following points:—

1. In every pound of Goldfinder there are 4 oz. of husk, whilst in a pound of Pioneer there are 5½ oz.

2. The black varieties, viz., Black Tartarian and Pioneer, have a high proportion of husk.

3. In almost every instance the percentage of husk in 1902 is smaller than in other years. Some, however, vary very little.

To arrive at the relative value of these varieties of oats, the husk must be in every instance taken from the grain, and the relative weight of the kernel, the most valuable part of the oat, estimated. To do this, Tables I. and II. should be compounded, and it will then be seen that the order of Table I. must be rearranged to place these varieties in their proper order of merit. Table *III.* furnishes the same result by showing the weights of the unshelled and shelled grain from the whole plot, a much more reliable and accurate method.

III.—WEIGHT PER PLOT OF UNSHELLED AND OF SHELLED GRAIN.

Name of Variety.	1900.		1901.		1902.		Average.	
	Unshelled grain.	Shelled grain.	Unshelled grain.	Shelled grain.	Unshelled grain.	Shelled grain.	Unshelled grain.	Shelled grain.
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Storm King	—	—	—	—	312	211·5	312	211·5
Banner	—	—	—	—	233	173·5	233	173·5
Newmarket	144	108·5	254	186	252	189	216·7	161·2
Abundance	147	111	231	170	257	193	211·7	158
Goldfinder	—	—	193	143	224	172·5	208·5	157·7
Waverley	150	110	226	165·5	260	195	212	156·8
Tartar King	149	101·5	158	104·5	297	208	201·3	138
Pioneer	140	89·5	204	131	238	163·5	194	128
Golden Giant... ...	89	62	138	98	198	150·5	141·7	103·5
Black Tartarian ...	102	72	140	97·5	188	135	143·3	101 5
Potato...	63	44·5	148	104·5	160	123	123·7	90·7
Longhoughton ...	66	46·5	139	99	164	126·5	123	90·7
Hamilton	83	59·5	138	97	150	115	123·7	90·5
Sandy	31	22·5	114	80	116	90	87	64·2

The following table, taken from Mr. H. Ingle's *Agricultural Chemistry*, shows the feeding value of the shelled grain as compared with the unshelled grain:—

DIGESTIBLE CONSTITUENTS IN OATS.

	Dry matter.	Protein.	Carbo-hydrates.	Fat.
	Per cent.	Per cent.	Per cent.	Per cent.
Oats in Husk	89	9·2	47·3	4·2
Oat Meal	92·1	11·5	52·1	5·9

Oat seeds grown in Scotland, and sown at Garforth, were found to produce oats with a smaller percentage of husk, but the weight of the grains was also, as a rule, diminished.

The first object of this experiment was to test the yield of the mixture as compared with either variety grown separately. Abundance and Black Tartarian oats were mixed and sown on plots which contained in the same series each variety sown separately. The following table shows the results of two years' experiments :—

YIELD OF OATS FROM ONE-TENTH ACRE.

Variety.	1901.		1902.		Average for the 2 years.		Average.	
	Saleable Corn.	Second Corn.	Saleable Corn.	Second Corn.	Saleable Corn.	Second Corn.	Saleable Corn.	Second Corn.
	lb.	lb.	lb.	lb.				
Abundance	231	10	257	44	244	27	204	33·5
Black Tartarian ...	140	5	188	75	164	40		
Mixture of Both ...	195	7	257	26	226	16·5	226	16·5

The second object of the experiment was to ascertain whether there was any change in the proportion of black and white oats in the crop as compared with the seed.

The plot, one-tenth of an acre, was sown at the rate of four bushels per acre. The seed corn consisted of equal weights of the white and black oats, a sample of which was found to contain the following proportion of grains :—

	Black Tartarian.	Abundance.	
	890	570	or roughly 3 Black : 2 White.
The crop showed the following ratio ...	1,265	2,970	,, ,, 3 Black : 7 White.

The white oats in the crop during 1901 thus increased three and a-half times compared with the black. A similar result was obtained in 1902. The reason for this has not yet been fully investigated.

WHEAT EXPERIMENTS.

Experiments have been conducted at Wye College upon the conditions affecting the quality of English wheat. The trials undertaken in 1902 have for their object the investigation of the effect of the soil upon the "strength" of the wheat grown on it.

Two varieties of seed were used, Square Head's Master and Red Lammas; the former selected as a typical large yielding, stiff-strawed sort, very largely grown by farmers, though from a miller's point of view deficient in "strength," and requiring a large admixture of foreign wheat to yield standard grades of flour; the latter, as a widely grown wheat, superior in quality, though producing an inferior yield and weaker straw.

Four crops of four acres each were grown, this area being sufficiently large to test the yield and the strength of the straw, and also to provide corn enough to put through the mill, so that a baking test could be made of the resulting flours. The whole produce of each plot was stacked and threshed separately.

Particulars of the plots and their yield are given in the following table:—

CROP PER ACRE.

Soil.	Sq. Head's Master.	Red Lammas.
	Grain, Bushels.	Grain, Bushels.
Light loam over chalk	25	29
Light sandy loam	59	45
Deep loam	58	45
Deep loam	46	42

It will be seen that the yield of the Square Head's Master is superior to the Red Lammas on all soils except the chalk. The latter, however, generally gave a better yield of straw.

The results of the milling and baking tests are not yet ready for publication.

In addition to the above, some strong seed wheats were obtained from Canada. They were the Red Fife, Preston and

Percy. They were not sown until April 21st, being delayed on the way. The season was wet, and the grain looked very poor, but on milling turned out to be probably the "strongest" wheat ever raised in this country, strong enough to make "London household" flour without admixture. These varieties are being tried afresh, both as winter and spring wheat, in many parts of the country this year. Red Fife yielded 28 to 30, Preston 24 to 25, and Percy 20 to 21 bushels per acre.

COLD CURING OF CHEESE.

In the last number of this *Journal* (Vol. IX. p. 516) some account was given of the experiments undertaken by Messrs. Babcock, Russell, Vivian, and Baer, at the Agricultural Experiment Station of the University of Wisconsin, in the curing of cheese, of Cheddar type, at low temperatures. These experiments have been continued, and the Nineteenth Annual Report of that Station contains particulars of the investigations conducted during 1901–2.

Of some of the series of experiments a preliminary report only could be given last year, since sufficient time had not elapsed to judge of the keeping qualities of much of the cheese made. The results now attained confirm those previously arrived at, namely, that cheese cured at 40 degrees Fahr. kept better than that cured at 60 degrees. Cheese which had been cured at 15 degrees cured slowly and was of inferior quality; nevertheless, such cheese, cured at 15 degrees, and subsequently removed and stored at 40 degrees, was up to standard quality at 14 months. Cheese cured at 60 degrees was by this time putrid.

Cheese cured at this temperature possesses a mild flavour, even when it is of considerable age; the texture is smooth, waxy, and silky, the body solid and the colour even. In no case, even with cheese kept for two years, was there any sharp flavour, such as usually accompanies an old cheese ripened under

ordinary conditions. In all respects the product at these lower temperatures was superior to that ripened at 60 degrees, the temperature that has hitherto been considered ideal for Cheddar ripening.

Duplicate cheeses, disposed of when in their prime at the local and Chicago markets, fetched from 1d. to 1½d. per lb. more than the market price; while it is stated that Prof. Robertson, Commissioner of Agriculture for Canada, examined the various cheeses when they were six months old, and indicated those cured at 40 degrees as those most likely to suit the English market.

As has been stated, one result of ripening the cheese at a low temperature is a relatively mild flavour; which is, in fact, sometimes too mild for some customers. Temperature thus exerts a strong influence on the intensity and quality of the flavour, and experiments were accordingly devised to ascertain whether cold-cured cheese, subsequently exposed to a higher temperature, could be made to develop more flavour without producing any disagreeably sharp and biting taste. In these trials the maintenance of the keeping quality, as well as other points, was kept in view.

The investigation showed that the mild flavours which characterise cold-cured cheese can be intensified by subsequent exposure to about 60 degrees without any sharpness being developed. But care must be taken that the temperature is not too high, nor must it be maintained too long, as in a partially cured cheese this subsequent enhancement in flavour develops rapidly.

In order to hold the desirable flavours for the longest possible time, and so lengthen the commercial "life" of the cheese, it should be returned to lower temperatures for storage as soon as the desired flavour is reached. Under such conditions further development is stopped, and such cheese may be kept unimpaired for several months.

Cheese cured at the lower temperatures indicated above naturally requires a considerably longer period to ripen than when a higher temperature is employed. In the Wisconsin experiments the cold cured cheese reached its prime in about six to eight months (a period partly controlled by the amount of rennet used—see below). This, of course, involves somewhat

greater expense for carrying charges; but this is said to be more than counterbalanced by the increased value derived from the improvement in quality and the diminution in loss of weight. This loss of weight is at its maximum with high curing temperatures. It was intended to carry out trials also in exposing cheese to a short preliminary ripening at 60 degrees, prior to keeping it at the lower temperatures during the main ripening period, which should have the effect of hastening the process. These experiments were only commenced during the current year, but it appears that such a hastening is possible, at all events, with cheese made from first class milk, but it would seem that considerable care has to be exercised.

Increased quantities of rennet have been shown, in earlier Reports issued by the Wisconsin Agricultural Experiment Station, to hasten the process of ripening, owing to the action of the pepsin contained in the rennet extract. At ordinary curing temperatures (60 degrees and above), however, an increased amount of rennet not only is accompanied by a more rapid breaking down of the casein, but also affects the flavour; the cheese does not keep long, and soon acquires a sharp rank taste. Experiments were devised to ascertain whether the employment of a larger quantity of rennet could be advantageously employed to hasten the ripening in the case of the cold cured cheese without causing deterioration, and cheeses were accordingly made with the normal amount (3 oz. per 1,000 lb. of milk), and with double and treble this quantity.

It was found that at the higher temperatures (60 degrees) the ordinary injurious effects of using too much rennet were apparent; but that at the lower temperatures the increased amount, while facilitating the ripening, also favourably influenced the texture, which was of a rich buttery nature. It is concluded that at 32 degrees and 40 degrees even 9 oz. of rennet per 1,000 lb. could be used with safety. However, the cheese made with 6 oz. of rennet was quite as good, and ripened almost as quickly. This latter cheese also had a tendency to retain the mild flavour better than that made with 9 oz.; and the authors are of opinion that the use of 6 oz. under cold curing conditions is, perhaps, preferable to using a larger amount. These experiments demonstrated that more than normal quantities can be used with

advantage, as they give a more buttery and softer texture, as well as hasten the ripening process.

In the cheese made at low temperatures there had been noticed in the previous year white specks more or less uniformly distributed throughout the cheese. Their nature is not as yet known, but they do not appear to affect the flavour or texture in any way, and from a commercial point of view they are not of much significance, as they are quite obscure. Some experiments have been made to discover the conditions which affect the development of these white specks. The chief factors determining their formation appear to be temperature and salt. Low temperatures favour their production, but they rarely appear at 60 degrees. The addition of salt tends to prevent their formation under all conditions, and they are not so apparent when increased quantities of rennet are used. They are especially abundant in skim cheese, but do not appear in very rich cheese, even at low temperatures; while in sweet curd cheese no specks were found at any temperature.

It is stated that the general results obtained in Wisconsin as to the superiority of cold cured cheese have been confirmed in Canada at the Ontario Agricultural College, and that the Canadian Government has already inaugurated an extended system of cold curing plants of this character in which the product is cured directly from the press.

Many dealers in the State of Wisconsin have begun to adopt this plan, and have bought a considerable quantity of cheese for cold curing direct from the press, with satisfactory results. A number of the wholesale dealers in Chicago are likewise cold curing a large portion of the product. The custom of placing cheese in cold storage for keeping has been followed for some time; at first this was only done with ripened cheese, but the tendency has lately been to shorten the period of curing at the factory and to put the cheese into storage earlier.

THE INFLUENCE OF PASTEURISATION OF CREAM ON THE YIELD AND QUALITY OF BUTTER.

A communication on the above subject was submitted to the recent International Agricultural Congress at Rome by Dr. Henseval, Director of the Belgian State Dairy Station, and M. Marcas, Professor at the Agricultural Institute, Gembloux.

The authors stated that the industrial pasteurisation of whole and skimmed milk is now generally admitted to be necessary in all co-operative dairies. Its object is, primarily, the destruction of pathogenic microbes. The pasteurisation of skimmed milk, moreover, prolongs its keeping qualities, and the product can consequently be employed more advantageously for feeding purposes.

The pasteurisation of cream is also necessary, inasmuch as it, like milk, contains injurious microbes in abundance. Another advantage obtained from the pasteurisation of cream consists in the destruction of micro-organisms which cause putrefaction. They exist in such great abundance in the cream that they occasionally neutralise the action of the lactic ferment, seriously interfere with the regular ripening of the cream, and communicate to the butter abnormal flavours. In order to obtain good butter it is therefore necessary to destroy the injurious microbes at the outset, so as to ensure the prominence and rapid development of the lactic ferment, whereby the acidity of the cream is increased and the development of the organisms of putrefaction is arrested.

It has been shown that the means of destroying the pathogenic microbes in whole and skimmed milk are not applicable in the case of cream, where these organisms are more resistant, and the pasteurisation of cream therefore involves technical and economical questions of great importance. In this connection, Messrs. Marcas and Henseval placed before the Congress the results of recent experiments as regards the following subjects :—

(1.) The effect of cream pasteurisation on the yield of butter.

This question has been investigated by several persons with various results, some of the experiments showing a loss and

others a gain in the yield of butter. The disagreement is partly due to the technical difficulties involved, and Messrs. Marcas and Henseval claim that in their experiments the margin of error was reduced to a minimum.

The details of the enquiry are too extensive to reproduce in detail, but the authors claim to have definitely proved that by the pasteurisation of cream the yield of butter is increased, although the quantity is too small to be taken into consideration in practical work. The increase appears to be due to a larger amount of water contained in the butter, as was apparently proved by Professor Storch from the result of over two hundred analyses of Danish butter, which gave the following results:—

Year.			Water in the butter per cent.	Observations.
1895	..	...	13·70	Pasteurisation not practised.
1896	...	...	13·69	
1897	...	...	13·79	Pasteurisation at 75 deg. C. practised in some dairies.
1898	...	...	13·93	Pasteurisation at 75 deg. C. practised in nearly all dairies.
1899	...	...	14·06	Pasteurisation at 85 deg. C. ordered by law.
1900	...	...	14·06	

(2.) The influence of pasteurisation on the quality of butter.

The curious taste imparted to milk and cream by the action of heat is well known. This taste, however, is not imparted by pasteurisation (with subsequent refrigeration), nor does it pass into the butter. Pasteurisation should, indeed, theoretically improve the aromatic qualities of butter, owing to the ripening of the cream under the most desirable conditions. In practice, however, various factors intervene and favourable results are not always obtained, and the varying taste of judges of butter, moreover, increases the difficulty in forming a reliable judgment. Messrs. Marcas and Henseval submitted their pasteurised butter to various persons, including two well-known experts, and all unanimously gave the preference to the butter obtained from pasteurised cream. This butter also, in confirmation of Danish experiments, proved to be of better keeping quality.

The results obtained by Messrs. Marcas and Henseval are summarised as follows: (1) The pasteurisation of cream destroys

a large number of microbes and enables the cream to ripen regularly and surely, by means of cultures of the lactic ferment; (2) Pasteurisation of cream slightly increases the yield of butter, which retains a little more water than butter not pasteurised; (3) Pasteurisation has a favourable effect on the "keeping" and quality of butter.

THE UTILISATION OF SKIMMED MILK.

A series of interesting investigations regarding the most remunerative method of utilising skimmed milk has been made by Professor Besana, Director of the Italian Experiment Station for Cheesemaking at Lodi in Lombardy, and a report on the results was read before the recent International Agricultural Congress. The development of the dairy industry has been very rapid during recent years in Lombardy, where the supply of skimmed milk has become much greater than the demand, and with a view to increase this demand Professor Besana has endeavoured to improve the value of the by-product as a food for calves and pigs by the addition of various nutritive substances. The following information refers to experiments made in this connection with starch and margarine.

A mixture of starch and skimmed milk was prepared by heating a portion of the liquid to a temperature of 176 deg. F., adding the starch gradually, and stirring the mixture in order to obtain a thick but homogeneous paste. The amount of starch added was in the proportion of 300 grammes per litre, or about 3 lb. per gallon. The paste was then mixed carefully with five times the original quantity of skimmed milk, and after heating to 99 deg. F., the liquid was fed to the calves with an ordinary teat. The other mixture was prepared as follows:—Margarine and skim milk were heated to a temperature of 50 deg. C. (122 deg. F.), mixed in the proportion of 6 litres of skimmed milk (10·76 pints) to every kilogramme of margarine (2·2 lb.), and thoroughly incorporated together by means of a hand emulsifier. This liquid contained from 16 to 17 per cent. of margarine, and this proportion was then reduced by the addition of more

skimmed milk. A mixture containing 2 per cent. of margarine was at first fed to the calves, and the proportion was gradually increased to 2·5 and 3 per cent. The food thus prepared was fed at a temperature of about 99 deg. F., and without delay, since the globules of margarine gradually rise to the surface of the liquid.

The experiments were made in the spring of 1902 with four calves of local breed, and due care was taken to obtain reliable comparative results. Two animals received the starch, and two others the margarine mixture, and the daily amount was regulated by the weight of the animal, viz., one-sixth at the beginning of the experiment, and one-fifth when the calves weighed about 150 lb. This food was not, however, added to the ration until the animals were at least a week old (or 110 lb. in weight), and then it was fed in small but increasing quantities until the whole milk was eventually eliminated.

The general results obtained indicated that the calves fed with the mixture of skimmed milk and starch increased in weight more rapidly than the others, viz., at the rate of 2·1 lb. per day, compared with 1·88 lb. in the case of the margarine mixture. The animals which received the last-mentioned food throve satisfactorily up to the end of the fourth week, but the increase in weight was not maintained after that period (*i.e.*, when calves naturally begin to consume other than liquid food), and the increase ceased when this food was continued after the animals were six weeks old. The meat from the animals fed on the starch mixture was, however, deficient in consistency, in colour, and in fat, whereas the margarine gave more satisfactory results from the butcher's point of view. The experiment was, on the whole, more favourable to the mixture with margarine, and its employment appears also to be more economical than starch in Italy.

THE HEGELUND METHOD OF MILKING.

Considerable interest has been aroused in Denmark and Sweden by a new process of milking, known as the "Hegelund method," which is advocated by J. J. Hegelund, a veterinary

surgeon acting as adviser to the cattle rearing societies in Aarhus. It is claimed for this method that it increases the production and improves the quality of the milk, and that it has a beneficial influence on the dairy qualities of the cows so milked.

The Hegelund method is thus described by the author.

The milking is done with dry hands and with the whole hand, the two fore teats being milked first, the right hand milks the left teat and the left hand the right teat. The milking is begun by lifting the hands alternately with a pressure against the udder, the teats being at the same time held loosely. When a considerable amount of milk has come down, each hand is lowered until the teat has its natural length, without being stretched. As the hand is lowered the teat is pressed from above downward with a gradually increasing pressure, and a continuous stream of milk is thus pressed out of the teat. At first the milking is done slowly, taking great care that the teat is not stretched, as stretching will cause the cow to hold up her milk. When the milk flows readily, the milking is proceeded with as rapidly as the milker can perform it, until but very little milk is obtained. There must be no interruption of the milking from the time the milk flows freely until the udder is emptied. As soon as a good flow of milk comes, the pressure against the udder mentioned above may be omitted. When only a thin stream of milk is obtained by this manipulation, the hand is again opened above, and while the lower fingers loosely hold the teats, thus remaining at the place most convenient for pressing the milk out of the teats, the hand is pressed against the udder, or its lower part is simply grasped so as to more easily secure a full stream of milk. When the fore teats do not give more milk, the hind teats are handled in the same way, but without beginning with the pressure against the udder.

The hind teats being emptied, the "clean milking" is begun. The fore teats are again grasped and the hands lifted to around the lower part of the fore quarters, taking hold of this, with the thumb on one side and the other fingers on the other. The milk is pressed into the milk cistern by means of a light pressure, and from there out of the teat, emptying the fore quarters. In milking the hind quarters the hand grasps with each grip well up around the hind part of the quarters.

The "after-milking" now follows, and is conducted in three different manipulations. In the first manipulation the right quarters are pressed against each other (if the udder is very large only one-quarter is taken at a time), the hind quarter being held from behind with the left hand, and the fore quarter with the right hand, in front. The hands are now pressed toward each other, while the milker at the same time lifts them toward the body of the cow. This pressing and lifting is repeated three times, and each time the hands are lowered in order to squeeze out the milk collected in the milk cistern. The left quarters are then manipulated in the same way.

In the second manipulation the quarters are pressed together from the opposite sides. The fore quarters are milked separately by placing a hand, with fingers spread, on each side of the quarter; the hands are pressed against each other three times and the teats then milked. When no more milk is obtained by this manipulation the hind quarters are milked by placing a hand on the outside of each quarter, likewise with fingers spread and turned upward, but with the thumb under the quarter, just in front of the hind teat. The hands are lifted and grasp into the gland from behind and from the side, after which they are lowered to draw the milk. The manipulation is repeated until no more milk is obtained.

The third manipulation consists in grasping the fore teats with partly closed hands and lifting the hands with a push up toward the body of the cow, both at the same time, by which method the glands are pressed between the hands and the body. The milk is drawn after each three pushes. When the fore teats are emptied the hind teats are milked in the same manner. The milking is then finished.

Experiments have been undertaken by Mr. F. W. Woll, at the Wisconsin Agricultural Experiment Station,* to ascertain precisely what results this method would give with the cows in the herd at that station. As soon as the regular milkers had finished milking in the ordinary way, the additional amount of milk was drawn by the manipulation described above; and the weights

* Nineteenth Annual Report of the Agricultural Experiment Station of the University of Wisconsin, 1901-2.

and analyses of the "regular" and "residual" milkings were recorded for five cows milked on the evening of June 3rd and for five others on the morning of June 4th, 1902. It was found that after the regular milking, the cows furnished from 1·0 to 3·55 lb. of milk by the second manipulation; the additional amount of fat varied from 0·1 to 0·27 lb.; and the fat content of the residual milk varied from 6 to 15 per cent. Or, calculating the gain as a percentage of the fat obtained at the regular milking, the increase in amount of fat varied from 9·9 to 32·5 per cent., according to the cow. The following table shows the average results from the ten cows:—

Average amount of milk per cow, regular milking	25·07 lb.
,, ,, ,, ,, residual ,, ...	2·04 ,,
Percentage of butter-fat, regular milking	3·96 per cent.
,, ,, ,, residual ,, ...	8·85 ,,
Amount of fat, regular milking	·99 lb.
,, ,, residual ,, ...	·18 ,,
Total amount of milk per cow	27·11 ,,
,, ,, fat ,, ...	1·17 ,,
Percentage of fat in total milk per cow	4·33 per cent.

The amount of milk per cow was thus increased by 8·1 per cent., and the amount of fat by 18·1 per cent.

The milk record of the herd shows that these ten cows twenty-four hours later gave in all 260·7 lb. of milk; about 10 lb. more than on the day of the trial, seven cows giving more milk and three less. No separate tests were made on this day, but the quantity showed that the thorough emptying of the udders had no tendency to reduce the amount yielded on the following day.

In view of the information thus obtained, a further trial was immediately started to ascertain whether this large increase would gradually disappear when the method was practised for a longer period. Three lots, of eight cows each, as uniform as possible as to period of lactation, age, breed, production of milk, &c., were selected. Lot I. was after-milked during the first and fourth weeks of the experiment, Lot III. during the second and fifth weeks, and Lot II. was after-milked every other day during the first two weeks and last two weeks. The trial lasted five weeks. The summary data of the main experiment are given in the following table:—

Lot.	Week.	Regular Milking.			Residual Milking.			TOTAL.		
		Milk.	Fat.	Fat.	Milk.	Fat.	Fat.	Milk.	Fat.	Fat.
		lb.	lb.	per cent.	lb.	lb.	per cent.	lb.	lb.	per cent.
I.	1	1,386·6	53·94	3·89	67·55	4·92	9·1	1,454·15	58·86	4·05
	2	1,377·8	53·76	3·90	...	...	...	1,377·8	53·76	3·90
	4	1,100·4	43·98	4·00	50·55	3·94	7·79	1,150·95	47·92	4·16
	5	1,170·6	46·82	4·00	...	...	...	1,170·6	46·82	4·00
II.	1 & 2	1,313·2	54·06	4·12	...	...	...	1,313·2	54·06	4·12
		1,303·8	54·23	4·16	57·95	5·53	9·54	1,361·75	59·76	4·39
	4 & 5	1,081·1	46·43	4·29	...	...	...	1,081·1	46·43	4·29
		1,084·5	46·45	4·28	52·65	4·80	9·11	1,137·15	51·25	4·51
III.	1	1,424·1	60·15	4·07	...	...	...	1,424·1	60·15	4·07
	2	1,396·9	58·10	4·16	61·45	5·25	8·54	1,458·35	63·35	4·34
	4	1,199·3	51·64	4·30	...	...	...	1,199·3	51·64	4·30
	5	1,220·3	52·29	4·29	48·65	4·08	8·38	1,270·75	56·37	4·44
TOTAL.	1 & 2	4,115·1	167·97	4·08	...	...	...	4,115·1	167·97	4·08
		4,087·3	166·27	4·07	186·95	15·70	8·40	4,274·25	181·97	4·26
	4 & 5	3,451·0	144·89	4·20	...	...	...	3,451·0	144·89	4·20
		3,405·2	142·72	4·19	151·85	12·82	8·45	3,558·85	155·54	4·37
	1—5	7,566·1	312·86	4·14	..	...	...	7,566·1	312·86	4·14
		7,492·9	308·99	4·12	338·8	28·52	8·42	7,833·1	337·51	4·31

The cows were subjected to great fluctuations as to weather conditions, while the condition of the pasture further necessitated repeated changes of feeding, and the disturbing effect of these conditions is shown in the milk records. Several of the cows were also in an advanced stage of their lactation period (though the three lots were similar in this respect), which accounts for a rather rapid decline in the milk produced.

As regards the regular milking, there is only a slight difference (less than 1 per cent.) in the production of milk and butter-fat in periods when after-milking was and was not practised, so that the yields obtained by the after-milking are essentially clear gain.

The total yield of all cows during the whole period was increased by 339 lb. (4·5 per cent.) and the butter-fat by 28·5 lb. (9·2 per cent.). The average amount of milk obtained by after-milking per day per cow was a little over 1 lb., containing 0·09 lb. of butter-fat; but the different cows gave very different amounts. The percentage increase in the production of fat was, as a rule, constant for each cow, and varied from less than 5 to

(in one case) 30 per cent. The breed seems to have nothing to do with the gain thus obtained, nor does the conformation of the udder.

It also became apparent on studying the figures that the variations in the results were partly due to the milkers, some individuals being able to obtain more from the after-milking process than others; a large extra yield often also meant that the "regular" milking had not been completely performed. Where the cows are milked clean at the ordinary milking, it is thought that the extra manipulation will not yield, on an average, more than about half a pound per day.

Since the strippings are the richest portion of the milking, it follows that the average fat content of the whole milking is raised by adding these to the bulk. The above figures indicate that by thorough milking—*i.e.*, clean milking in the ordinary sense followed by manipulation of the udder—the average fat content of a cow or a herd may be raised by 0·1 to 0·6 per cent., according to the thoroughness of the ordinary milking previously prevailing.

Including cows tested by several farmers in the State of Wisconsin, as well as at the Experiment Station, some 150 cows have been subjected to these manipulation trials. Of these, about a dozen, which were normally inclined to give trouble at ordinary times, objected to the after-milking, the third manipulation being generally the part of the method they did not like; the remainder of the cows, on the other hand, seemed to like the process.

It was observed that the Hegelund manipulation had a tendency to better maintain the flow of milk at its maximum during the lactation period. It is well known that there is no more certain method of drying off a cow than by leaving a considerable amount of milk in the udder for a number of milkings. The complete emptying of the udder, on the other hand, stimulates the glands into renewed activity. This is especially the case with heifers coming in. Single cases are on record showing that in some instances it has been possible to nearly double the production of young heifers in the course of a couple of weeks, even when the frequent milking by the manipulation method was not begun until they had apparently reached their maximum yield.

RIPE AND UNRIPE HONEY.

The Canadian Ministry of Agriculture undertook experiments in 1901 to ascertain what differences might exist between honey taken from uncapped and capped comb. Honey from the former is known to bee-keepers as immature or unripe, and is generally held to have poor keeping qualities. Endeavour was also made to ascertain the effect upon extracted honey of keeping it in a closed vessel (a glass-stoppered bottle), and open to the air (a vessel covered with cheese-cloth). The honey was extracted from the uncapped and partially capped comb on July 1st (1901), and from the fully capped comb on August 6th; the analyses being made on October 1st.

It was found that the honey from the the fully capped comb contained 4-5 per cent. less water than that from the partially or entirely uncapped comb. The difference in moisture content between the honeys kept in glass-stoppered bottles and in bottles covered with cheese-cloth was so small that no conclusions could be drawn as to the relative merits of these two methods of keeping honey. The honey from uncapped and partially capped comb was found to have decidedly poor keeping qualities compared with the other, several of the jars of unripe honey being fermented in October.

Similar trials were again conducted in 1902.

It was found that the considerable difference observed in the previous year between the water content of ripe and unripe honey was no longer apparent, although the latter contained a somewhat higher percentage. Evidently the character of the season has an influence in this matter, and it is quite possible that in some seasons the honey may be of practically equal quality. In the case of honey from the fully capped comb, it would appear that it absorbed moisture from the air to a slight extent when covered with cheese-cloth, and experiments are to be carried out to obtain further light upon this as well as other points.

THE PINE BEETLE.

(*Hylesinus piniperda* L.).

This is one of the most destructive of forest insects, and, in this country, is met with wherever pines are grown.

FIG. 1.—PINE BEETLE, MAGNIFIED ABOUT SIX TIMES.

Description and Life History.

The mature beetle* (Fig. 1) is about one-fifth of an inch long, dark brown or almost black in colour, and thinly covered with brown hairs springing from little tubercles, which, on the wing-cases, are disposed in rows between lines of punctures. These rows of tubercles are continued to the very edge of the posterior margin of each wing-case, except in the case of the second row on each wing-case, counting from the middle of the back, where the hairy tubercles cease at the point where the wing-case begins to bend down towards the apex. The discontinuance of the tubercles in these two rows is the main point of distinction between this insect and *H. minor*, Htg. The latter, however, is as rare as the former is common. The feelers (antennæ) are rusty brown in colour, relatively short, and end in jointed clubs. The thorax, except in the middle, is thickly covered with shallow punctures, but not disposed in rows as on the wing-cases. The larvæ are white, bent, and footless, with a brown head.

The beetles pass the winter under a variety of cover, and take wing during sunny weather about the end of March. They at once congregate for breeding purposes on the bark of pines that have died or that have been felled during the previous

* The illustrations are reproduced, by permission, from Trans. High. & Agric. Soc. of Scot.

autumn or winter. Trees that have been dead longer than the period indicated are not attractive to the insects. All kinds of true pines, such as the Scots Pine, Black Austrian Pine, &c., are used for breeding purposes; and occasionally, though very rarely, the spruce, larch, and other conifers are also utilised. Trees or boughs of a size to carry thick rough bark are chiefly infested by the insect for purposes of breeding; young trees, or branches with comparatively thin smooth bark, are largely avoided. The insects pair and proceed to bore into the bark, making a passage between the bark and the wood, the latter, however, being hardly broken. This passage has a slight bend at the starting-point, but afterwards is nearly straight (Fig. 2). It is usually about

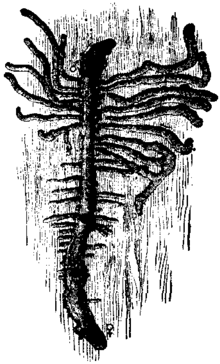

FIG. 2.—MOTHER AND LARVAL GALLERIES, SHEWING TWO AIR-HOLES, NATURAL SIZE. THE MALE KEEPS NEAR THE ENTRANCE, WHILE THE FEMALE CARRIES ON THE WORK OF EXCAVATION.

four inches long, and is generally supplied with one or more air-holes besides that by which the pair of insects entered. In making this gallery the dust is thrown to the outside, where its presence quickly attracts the attention of an experienced observer.

As the gallery is proceeded with the female beetle lays about 100 eggs, depositing them alternately on either side, and these produce larvæ in about a fortnight. The larvæ proceed to eat into the inner bark (bast) at right angles to the main passage,

and in a month or so they pupate, that is, form chrysalids, in the bark. A week or two later the chrysalids change into beetles, which eat their way out to the surface. As it generally happens that a very large number of beetles breed in the same tree, the surface of the bark after the young beetles have emerged looks as though a charge of No. 6 shot had been fired into it.

So far as dead or dying trees are concerned, the action of the insect up to this point is not of serious economic importance. So long as it can get such trees in which to breed, it will not attack healthy trees, but should suitable breeding material not be present, it may make its breeding galleries in comparatively sound stems, which will soon be seriously crippled, or killed outright.

The young beetles generally appear in June, and they may do *one or other of two things*. They *may either fly off* to other pine stems that have been felled or have been dead for a few months, in which case they pair and breed just like their parents. In such an event we have what is called a double generation, that is, two broods in a single season. But more frequently the

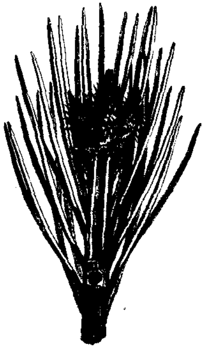

FIG. 3—PINE SHOOT WITH SLICE REMOVED TO SHEW PASSAGE MADE BY THE BEETLE.

young beetles do not breed in the year in which they are hatched. In this case they fly singly to the young shoots of the Scots or other pine, and into such shoots they bore, usually two inches

or so beneath the terminal bud. Having reached the pith, the beetle bores upwards, but the passage thus made is only occupied for food or shelter, never for breeding, which is only performed underneath the bark of trees in the manner just described.

As a result of the leading shoot of a stem or branch being hollowed out in the centre, it generally dies, or is broken off by the wind, and the trees become much deformed. They also lose a considerable quantity of their foliage, and the yield of cones may also suffer to a serious extent, a matter of importance in natural regeneration. It is to this action of the beetle that the chief sylvicultural damage is due. Trees so affected become characteristically mis-shapen, and are easily recognised, even at a long distance. Underneath infested trees, especially after a high wind in autumn, the ground will often be found thickly strewn with the tips of shoots, each with a cavity in the centre, and not infrequently containing the beetle. On young, vigorous trees, especially in a sheltered situation, the shoots do not so frequently break off, but the sickly appearance of the leaves, and an outflow of resin from the entrance hole, readily attract attention to the damage, and on cutting the shoot open the beetle will often be found at work in the central gallery.

The result of the action of the insect in destroying the ends of the branches, and frequently causing them to drop off, has earned for it in Germany the name of Wood Gardener or Tree-pruner, a designation first suggested by Linnæus.

Young trees, though severely crippled and reduced to the condition of mis-shapen bushes, are not often actually killed by the pine beetle; but old trees, whose shoots are more exposed to the wind, and being thin, are easily broken off when injured, are often completely destroyed by the persistent attack of this insect. Such a result will most frequently be observed in the neighbourhood of a saw mill, or of any place where pine logs are stored. Often, when a small proportion of standard pines are retained to grow when a wood is felled, it is found that such standards become unhealthy and soon die. This result is due to the fact that the felling of the wood has provided the insects with abundant opportunities for propagation (stumps, stools, stems, &c.), and from these in the month of June the standard trees are invaded by swarms of beetles. If the change that is

induced in the appearance of their crowns be observed, the appropriateness of the name Tree-pruner will be at once apparent.

Preventive Measures.

Widespread and destructive as this insect is under irrational methods of forestry, it is by no means difficult to combat. This is secured either by preventing its getting suitable material in which to breed, or by providing it with such material, but taking care that the young beetles are destroyed before they have escaped from the places where they are bred.

Most trees are felled in autumn and winter, and to leave pines lying in their bark in or near woods till the middle of the following summer is a sure way to propagate this and many other destructive forest insects. There need be no fear of the pine beetle breeding in stems from which the bark has been removed, but the barking of winter-felled pines is a somewhat expensive proceeding. The removal of the trees, or their conversion before the month of June, should always be attended to, but the ideal method of procedure is as follows. Let the trees felled in autumn or winter remain in or near the wood till the month of May, by which time they will have attracted most of the pine beetles in the neighbourhood. Before the end of May all such trees should be barked, and as, by that time, the stems will be thickly beset with larvæ, the bark can be removed quite easily. In delaying the process of barking till May the logs are not only rendered unfit to serve as future breeding places, but, what is most important, they are utilised as lures or traps, to which a large proportion of the beetles in the neighbourhood are attracted, and in which they are subsequently destroyed. On no account, however, must barking be delayed beyond the end of May. The bark removed should be deposited so that its inner surface, where the larvæ and chrysalids are found, is freely exposed to the sun and birds, and if this is attended to there is small chance of any of the young insects escaping. It is only when the bark is very thick that there is a likelihood of the immature insects completing their development in the bark after it is stripped off, and, in such a case, burning may be undertaken.

Small brushwood does not offer satisfactory breeding facilities

for this insect, but it may serve the purpose for others, so that it is well to destroy it. Large branches, however, should be treated as recommended for stems. The Pine Beetle will also breed in the part of the stools above ground, and in the month of May the bark of stools should be pressed off by means of a spade, or other suitable tool, and, being generally thick, should be burned.

All pines that die in the course of the summer should be felled and barked within two months.

By attending to these simple directions most of the damage from which an important section of our forest trees suffers through the attack of this insect will be avoided.*

THE HOP APHIS.*

The chief insect pest with which the hop grower has to contend is the Hop Aphis (*Phorodon humuli*), also known as the Hop "Fly" or "Louse." In former years, before the introduction of washing to combat this pest, the hop crop was often almost entirely destroyed by its attacks; hops would rise to famine prices, since so few could be picked from the gardens which partially recovered from the invasion or had escaped it wholly. The last general "black blight" occurred in 1882, since which year washing has been universal among the good growers of hops, but even the past three years have seen attacks which have seriously affected the crop either in quality or in yield. Early in June the first symptoms of an attack are usually to be seen; here and there among the hops will be found a stout-winged green aphis, and on the underside of the unfolding leaves, near the tips of the shoots, minute wingless "lice" may be detected, the soft growing points of the plant being always the part first attacked. If the weather conditions are favourable and nothing is done, the aphis multiplies with inconceivable rapidity; in a week or two the undersides of all the leaves become dotted over with wingless lice of all sizes, while the sticky exudations from

* Copies of this article, in leaflet form, may be obtained free of charge and post free, on application to the Secretary, Board of Agriculture, 4, Whitehall Place, London, S.W.

the insects coat the leaves below and give them a dark, shiny appearance. Finally, this "honey dew" turns black, the growing shoots shrivel and curl, and the development of the whole plant ceases. Sometimes after such a "black blight" the plant clears itself later in the season, and should heavy rain wash the leaves, it will put forth a little new growth on which a few hops will be carried. Should the conditions be less favourable for the rapid multiplication of the aphis, lice may be found on the plant during the whole season and will then harbour in the cones of the hops; as they die there the remains turn black owing to the invasion of a fungus, and the hops, after picking and drying, will be found with black cores, by which their value is much deteriorated.

Description and Life History.

The Hop Aphis belongs to the large family of plant lice, which includes many of the most characteristic pests of the farm and garden, such as the well-known "green fly" of the rose, the black "collier" which infests the tops of broad beans, the black cherry louse, the lice of apples, plums, and currants, the aphis of corn and of the turnip, &c.

The mature form of the Hop Aphis is about one-eighth inch long, with a plump body and three pairs of legs; the mouth is prolonged into a proboscis adapted for piercing the leaves of the plant and sucking the sap upon which the insects live; towards the extremity of the abdomen are two tubes from which exude the sticky "honey dew." Two pairs of transparent wings may or may not be present; for both winged and wingless female forms occur, the former being generally distinguished as "fly" from the wingless "lice"; there is also a winged male.

Two cycles of life history are known; one complete on the hop, the other involving a migration from the sloe, damson or plum back to the hop again.

In the first cycle the wingless female form hibernates in the ground and crawls on to the hop plant in the spring, when she immediately begins to deposit living young upon the soft leaves. These young in their turn begin to reproduce themselves without the intervention of a male for many generations, multiplying with astonishing rapidity. Some of these lice enter the pupal state, from which they emerge as winged females and fly to

other hop plants, where they again reproduce themselves asexually. Finally, towards the autumn most of the lice turn into pupæ, and emerge as winged females and males, which copulate before leaving the hop. Some of the wingless females go to ground before winter and hibernate until they can resume their asexual reproduction on the young hop in the spring.

In the second cycle the winged female, after fertilisation by the male in autumn, leaves the hop and flies to the sloes, damsons or plums, where she deposits eggs near the tips of the shoots and in the forks of the twigs. In the spring these eggs hatch into lice, which in May or early June develop wings; the winged females then fly back to the hops, where they reproduce living lice as before described for ten or twelve generations before fresh winged forms are developed. It is the enormous rapidity with which the wingless forms reproduce themselves that constitutes the danger of an attack of the Hop Aphis; the whole plant may become completely smothered in lice if neglected for a week or two. This latter cycle is the most important.

Natural Enemies.

The lady-birds, both in their adult and larval forms (when they are known in the hop gardens as "niggers"), are great devourers of aphis, and are sometimes numerous enough to keep a mild attack in check.

The lace-wing fly, which lays its white eggs in little groups, each supported on a long stalk, on the underside of the leaves of the hop and other plants, devours great numbers of aphides when in the larval stage.

Several species of chalcid fly are parasitic upon aphis; they lay their eggs in the living aphis, the interior of which is devoured by the larvæ.

Treatment.

The only way of dealing with the Hop Aphis is to spray or "wash" the hops with a mixture containing soft soap as a basis. As the aphis secretes something of a sticky or waxy nature, it is not readily wetted by pure water; the presence of the soft soap causes the wash to touch the aphis, and as it dries the thin layer of soft soap clogs the breathing pores and kills the insect. A few growers use soft soap alone; the majority add a decoction

of quassia chips, the bitter principle of which is either directly poisonous to the aphis or renders the leaves distasteful to those which escape. Paraffin reduced to a fine emulsion in the soft soap mixture is also employed; though extremely effective, killing the aphis at once, it requires to be used with great care. However carefully the emulsion is prepared, the paraffin has a tendency to separate and collect in sensible drops, which scorch any foliage on which they fall. Mr. Cousins, late of the Wye College, overcame this difficulty by dissolving naphthalene in the paraffin, thus rendering it heavier and diminishing the tendency to separate. There are also other patented preparations, but the majority of growers still use quassia and soft soap.

The soft soap should be carefully selected; it should be newly-made, and from such kinds of oil as do not yield hard flocks of curd when the soap is mixed with hard water. It is advisable to test beforehand the lathering powers and the character of the curd that is formed by dissolving $\frac{1}{5}$ oz. of the soap in question in half a gallon of water, shaking well, and observing the stability of the latter, and whether any curd separates on standing. The amount of soap to be employed varies with the hardness of the water; with soft water 4 lb. per 100 gallons will be sufficient, while hard waters often require 8 or 10. Large quantities of soft soap will scorch tender foliage; hence when the water is hard it is advisable to have an analysis made, as it is often possible to reduce the hardness by adding a little carbonate of soda.

Six pounds of good quassia chips are simmered for two hours, with just enough water to keep the mass liquid; the decoction is strained off, and the soft soap is stirred in till it dissolves, a process which may be assisted by further boiling. This stock mixture is diluted down as required with cold water to 100 gallons.

Many forms of spraying machines are used for distributing the wash. For small gardens, a hand machine with two nozzles on flexible tubes is used, but large acreages require the use of horse machines holding about 80 gallons of wash, the double or triple-acting pump being driven from the wheels of the machine as it moves along. From an account of competitive trials of various machines, the *Journal of the Royal Agricultural Society* for 1899,

p. 548, may be consulted. The spray should be fine, but not so fine as to become practically a mist, the object being to drive the wash with sufficient force to thoroughly wet every leaf of the growing plant. The amount of wash required will vary with the machine and the state of the bine. For a fully-grown garden, 200–400 gallons per acre will be needed.

Washing should begin as soon as lice are detected on the young leaves. It is almost impossible to clean the garden if once the aphis is allowed to get a start. In bad seasons washing may have to be repeated again and again, practically continuously throughout June, July, and early August. Every effort should be made to get the plant clean before the hops begin to form, as *it is impossible to reach the aphis if once it gets a lodgment* inside the cones of the hop. For this reason a late attack of aphis is the most dreaded by the hop-grower, because he is then powerless to stamp it out, though washing right up to the time of picking will keep down the numbers which enter the hop. The lower leaves and laterals, and suckers about the base of the plant, should be stripped away, as they harbour lice and are difficult to wash.

The cost of washing on a large scale amounts to about 20s. per acre for both materials and labour, but much depends on the proximity of the water supply.

As the hop aphis in the main migrates from the sloe, damson and plum to the hop, the use of the Caustic Wash, described in Leaflet No. 70, on the fruit plantations in the winter will tend to diminish the attack on the hops in the following summer by destroying the eggs of the aphis.

A rather stronger preparation of the wash above described is equally effective against other kinds of aphis. It is particularly necessary to attack those infesting the apple and plum at an early stage, for they very soon cause the leaves to curl and protect themselves from any possible spraying.

Other Insect Pests of the Hop.

The Hop Flea (*Haltica concinna*), a near relative of the common Turnip Flea Beetle, is often a serious trouble to hop-growers. In early spring it attacks the young bine and devours the first leaves. Towards harvest it harbours in the hops them-

selves, which it riddles with holes as though a charge of small shot had been fired at them. No wash is effective against these active little pests, but as they harbour under the clods on the ground their numbers can be materially reduced by running chickens in the hop gardens. In the early spring dusting soot and lime over the hills has been found useful.

Various bugs, like the Needle-nosed Hop-bug (*Calocoris fulvomaculatus*), Jumpers (*Euacanthus interruptus*), &c., and Earwigs (*Forficula auricularia*) occasionally attack hops, especially where they are grown upon poles. Shaking or jarring the plants over a tarred board for the former and trapping for the latter are the only possible remedies.

DESTRUCTION OF WEEVILS ON THE ROOTS OF POT PLANTS.

In cases where the roots of plants in pots are attacked by weevils or maggots the plants may be watered with the following mixture:—Dissolve 1 quart of soft soap in 1 gallon of boiling soft water, and add 1 pint of crude carbolic acid. Mix the whole into an emulsion by means of a force pump. This mixture will keep some time if bottled and kept air-tight. When used, dilute with thirty times the amount of water. It is best to remove a little of the earth round the roots before watering with this mixture. Should the emulsion become semi-solid, it may be dissolved in some warm water first. This mixture has been found very successful in treating the larvæ of weevils and flies attacking the roots of plants, and is better than a mixture of carbolic acid and water alone.

GROUND BEETLES AND STRAWBERRIES.

Several species of ground beetles attack strawberries, including the following: *Harpalus ruficornis*, Fabr., *Omaseus vulgaris*, Linn., *Steropus madidus*, and *Calathus cisteloides*, Panzer.

These beetles attack the berries at night, usually just when the fruit is ripening. The insects remain under the earth, straw or grass between the rows during the day, making holes in the soil and having regular runs opening through the litter. Green

fruit is also attacked, the skin being eaten away, the seeds usually being left intact. There are, nevertheless, records of the seeds also being eaten, the ground being described as being covered with a powdery deposit, caused by the seeds eaten off the berries.

The most destructive species appears to be *H. ruficornis*, which is winged, and which evidently migrates in large numbers.

These beetles will feed on other substances, such as live worms, meat (cooked and uncooked), &c.

Treatment.

The only successful plan is to sink small pudding basins in the soil between the plants every few yards and baiting them with lights and sugar water. The beetles swarm to this, and are unable to crawl back up the sides of the basins. Similar good results have been gained by using ordinary jam pots or glass jars.

Probably poisoned baits would act well, but trapping, as given above, is a well-tried and most successful plan.

THE RASPBERRY BEETLE.

The Raspberry Beetle (*Byturus tomentosus*) is one of the regular raspberry pests, occurring in more or less abundance every year in this country. Besides the raspberry, it also attacks the cultivated and wild blackberries, and gardens may often be invaded from the latter. The beetles generally attack the opened blossoms as early as the middle of May, eating their way right through them ; but if the blossom is backward they may eat the unopened bud. When the fruit is ripening the larvæ attack it, living in the receptacle and sometimes crawling over the fruit. The fruit attacked by these maggots is usually deformed and stunted, and often shrivels up altogether.

The beetle is dark brown in colour, with a dense golden-brown pubescence, which may assume a dull greyish hue ; the legs are reddish-yellow or reddish-brown. The beetles fly readily in bright weather. In length the mature beetle is

about a sixth of an inch. As soon as the flowers open the beetles, as already noticed, feed upon them, and deposit eggs singly deep in a blossom, often just as the bud is opening. The larva is of a dull yellow colour, with brown markings, though the colour varies somewhat, and some specimens are almost grey. It has six jointed legs in front, and two pointed curved spines behind. The maggots are full-grown about the time the fruit is ripe. They are then about a third of an inch long, and a cylindrical process acting as a proleg may be noticed beneath the last segment. When full grown they leave the fruit and crawl to some shelter, such as crevices in the poles, under the rough rind of the canes, or the earth around the stocks. There they pupate and remain all the winter, the beetles emerging in the spring when the flower-buds are bursting.

When large numbers of the beetles are noticed about the raspberries in May or early June, it would be well to go over the beds, holding a tarred sack or boards on each side of the rows, and jar the beetles on to them. This should be done on dull days, as the beetles are very active in bright sunshine, and would fly some distance.

All prunings and rubbish should be burnt in the winter, so as to destroy pupæ; the old bearing wood should always be burnt. In the early spring paraffin and ashes might be hoed into the ground near the stocks.

HINTS ON THE SELECTION OF PORTIONS OF DISEASED PLANTS INTENDED FOR INVESTIGATION.

Mutual disappointment on the part of sender and receiver is too often experienced, when plants, supposed to be diseased, are submitted for examination. Principal among reasons for this state of things, are one or more of the following :—

1. The fragmentary nature of the material sent for investigation.

2. Lack of care in transmitting; the specimen arriving shrivelled or dead.

3. Absence of information as to the conditions under which the plant grew.

The following suggestions, if acted upon as far as practicable, would materially assist in reducing the number of such disappointments.

In selecting material, endeavour to illustrate every phase of the disease from the earliest indication of its presence up to the death of the part affected. In the case of an epidemic among herbaceous plants, cereals, &c., one or several entire plants should be sent. Detached leaves alone are as a rule useless. The root, after the soil has been shaken off, should be sent if practicable, as in many instances the primary cause of trouble is located there; the stem and leaves as a result of this root-disease, become limp and very susceptible to the attacks of fungi. Now it is obvious that examination of leaves or stem in a case like the one just described, would fail to indicate the primary cause of disease in the plant.

Material for transmission through the post should be carefully packed in a box and wrapped up in waterproof paper. Never use cotton-wool for packing. Specimens sent in letters or paper parcels usually arrive dried up and useless.

Information as to the conditions of life of diseased plants is of value. If grown out of doors, the nature of the soil, drainage, aspect and surrounding vegetation should be noted. When grown under glass, state average temperature, humidity, method of watering, kind of fertiliser used; also whether an apparently similar kind of disease had been previously observed.

In addition to the living material as indicated above, it is always of advantage to receive characteristic examples of the disease in various stages, preserved in methylated spirit.

YELLOW SPOTS ON BLACK CURRANT BUDS AND LEAVES.

The Board are sometimes asked whether the small yellow spots, visible on the buds and leaves of the black currant, have any connection with the Black Currant Mite (*Eriosyphes ribis*). Although at one time there was supposed to be such a connection, further investigation has shown that these "galls" are not due to the mite, but are "glands" or organs secreting a pungent oil, and are in fact not diseased, but healthy structures natural to the younger parts of the black currant plant itself.

INSURANCE AGAINST LIABILITIES UNDER THE WORKMEN'S COMPENSATION ACT, 1900.

The Board of Agriculture have recently made enquiries with regard to the character of the policies issued at different rates of premiums by the leading insurance companies in connection with the insurance of farmers and others against the liabilities imposed upon them by the Workmen's Compensation Act 1900, and other Acts. Soon after the introduction of the Act of 1900, farmers' insurance policies were offered at as low a premium as 3s. per £100 of wages paid. But there has since been a readjustment of these premiums, and the rates now charged by the leading insurance companies range from 5s. for every £100 of wages paid. This premium (5s.) is for a policy which provides for compensation, on the basis of the Workmen's Compensation Acts, 1897 and 1900, for all accidents occurring to workmen in the course of employment in agriculture, and which covers in addition the liability of farmers and others in connection with accidents to their servants under the Employers' Liability Act 1880, the Fatal Accidents Act 1846, and at Common Law. In some cases the rate charged for a policy of this kind is 5s. per £100 of wages paid, with a minimum of 7s. 6d.; in others it is 6s., with a minimum of 10s.

In cases in which it is desired that the policy should cover compensation for accidents for the first two weeks' disablement (which is not provided for by the Workmen's Compensation Acts), the premiums range from 6s. per £100 of wages paid. Some companies charge a premium of 8s. for this class of policy, with a minimum of 12s. Policies are also issued which not only afford protection against the legal liability of employers, but also provide compensation where there is no legal liability. In the latter case, however, the weekly payments in cases of disablement are limited by some companies to 26 weeks and the amount payable at death to £100.

In taking out a policy, therefore, insurers should make careful enquiry as to the extent of the liability covered by the policy. In this connection the following hints from a leaflet

prepared for the Agricultural Organisation Society by Mr. W. Fitzherbert-Brockholes, may be of interest :—

To insure satisfactorily and well, it is necessary to bear the following points in mind :—

1. Ascertain the soundness of the company in which you think of insuring.

2. Beware of the drawbacks and risk of insuring against legal liability only.

3. See whether there be any time limit in compensations for disablement, or any reduction in the minimum of £150 and maximum of £300 in cases of death.

4. Consider whether it is not advisable to include the first 14 days in your insurance.

5. Remember to add the value of any board, lodging, house-rent, &c., to the actual wages paid when making up your estimate for the purpose of an insurance policy; also, bear in mind that females employed in any kind of farm work come under the provisions of the Acts.

6. Be sure to include a margin for "casual labour" in the calculations of wages paid; and, also, that the wording of the policy distinctly covers accidents happening to workmen in the employment of the insured wherever they may be in the United Kingdom.

7. Examine carefully the wording of the policy so as to make certain it conveys clearly the conditions you desire.

8. When you get your policy, carefully study the regulations laid down for insurers to follow, and bear them in mind, lest you may forfeit some of the benefits to which you are entitled through some oversight or neglect.

COMPENSATION FOR MILK LOST IN TRANSIT BY RAIL.

The Board of Agriculture have been in communication with the Great Western Railway Company with regard to certain resolutions addressed to the Department by the North-East Somerset Farmers' Club, and by the British Dairy Farmers' Association, as to the payment of compensation for milk lost and for milk churns lost or damaged while being conveyed on the Company's system. The Board are informed that the Company will be prepared, as they have been in the past, to consider claims in respect of the total loss of churns of milk in transit, and will not refuse to make reasonable compensation in such cases, contributory negligence on the part of the senders or consignees being, of course, taken into consideration. The Company will also not object to consider claims made for reasonable compensation in respect of milk lost or churns damaged, having regard to the circumstances under which the loss or damage occurred.

COMMITTEE ON DIPPING OF SHEEP.

The Board of Agriculture have appointed a Departmental Committee to investigate experimentally, and to inquire into and report upon :—

1. The composition and essential constituents of efficient dips and other preparations for the treatment and dressing of sheep, and their effect upon the animal treated or dressed, and upon the parasites and other organisms for the destruction of which they are used.
2. The methods in which such dips and other preparations should be employed, and the appliances and facilities requisite for the purpose.
3. The times and intervals at which sheep should be treated or dressed, regard being had (*a*) to the life-history and characteristics of the sheep-scab acarus and of the other parasites and organisms of sheep which require external treatment, and (*b*) to the practical conditions under which sheep-farming is carried on in various parts of the United Kingdom.

The Committee consists of the following gentlemen, viz. :—Mr. Laurence Hardy, M.P. (chairman); Sir Henry Hall Scott; Dr. Thomas E. Thorpe, C.B., F.R.S., Director of the Government Laboratory; Professor Edwin Ray Lankester, M.A., LL.D., F.R.S., Director of the British Museum (Natural History Department); Mr. J. Bowen-Jones; Professor John Rich Campbell, B.Sc., one of the Assistant Secretaries to the Department of Agriculture and Technical Instruction for Ireland; Mr. A. C. Cope, M.R.C.V.S., Chief Veterinary Officer of the Board of Agriculture; Mr. John Craig; Mr. Matthew Flanagan, J.P.; Mr. M. Hedley, F.R.C.V.S., one of the Chief Inspectors of the Department of Agriculture and Technical Instruction for Ireland; and Dr. William Somerville, one of the Assistant Secretaries of the Board of Agriculture. Professor Winter, M.A., University College of North Wales, Bangor, is the Secretary to the Committee.

GRAIN FREIGHTS IN 1901 AND 1902.

Freights on grain from some of the chief exporting countries were lower in 1902 than for several years previously. From San Francisco, Odessa, Bombay, and the River Plate they stood at about the level of 1897, but from New York the average rate was nearly the same as in 1901, viz., 4s. 9¼d. per ton, or about 1½d. per bushel, as against 4s. 5d. in the preceding year, which is probably a lower rate than has ever been continuously in operation for so long a period. In December, 1901, and January, 1902, it fell to 1d. a bushel, but at the end of the latter month an agreement was made between the principal Transatlantic lines fixing the minimum grain rate at 1½d. per bushel, and since then quotations have remained at 4s. 11d. per ton.

The following average annual rates for the past six years have been calculated from the *Corn Trade News*:—

	1897.		1898.		1899.		1900.		1901.		1902.	
	per ton.		per ton.		per ton.		per ton.		per ton.		per ton.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
New York to Liverpool	9	6	10	7	8	2¼	11	4	4	5	4	9¼
San Francisco to United Kingdom	22	3	25	10	30	0	39	1½	36	10¼	22	8
Odessa to London, Havre, Antwerp, or Rouen	8	8¼	10	2	8	10	10	11½	8	9¼	8	4
Bombay to Liverpool ...	11	3	18	5¼	17	3	16	11½	14	2	12	10½
River Plate (down river) to the United Kingdom	10	4	15	3	20	5	18	1	12	11¼	11	5

The charges from New York are for what are known as "berth rates," that is for accommodation in ships carrying a general cargo, and they frequently vary very considerably from month to month according to supply and demand. The rates for "full cargoes," that is, for a ship loaded only with grain, are lower than berth rates—being, according to the *Weekly Freight Circular*, from 1s. 6d. to 2s. 3d. per ton from New York to the United

Kingdom, but the quantity of grain thus brought to this country is apparently small.

The rate in 1902 from Odessa to London, Havre, Antwerp, or Rouen was 8s. 4d. per ton, the next lowest rate to that from New York. From Bombay it was 12s. 10½d., and in 1902 the imports from India exceeded those from either Argentina or Russia. From the River Plate it was 11s. 5d. from "down river" ports, such as Buenos Ayres, and 13s. 9d. for "up river" ports, such as Rosario, while from San Francisco the rate was 22s. 8d. per ton, compared with 36s. 10d. in the preceding year, a reduction which seems to be reflected in the increased quantities of wheat received from the Pacific coast of the United States.

In addition, however, to ocean transport, the bulk of the grain coming to this country has to bear considerable charges for movement to the port of shipment. In the case of the United States, information is given in the *Statistical Abstract of the United States* as to the average cost of transport from Chicago and St. Louis to New York and to ports in the United Kingdom. Complete figures are not yet available for 1902, but for 1901 the through rates were appreciably lower than in any preceding year, and it is believed that there was a further decline in 1902.

From Chicago to Liverpool the average rate in 1901, according to the Chicago Board of Trade, was 21.47 cents per 100 lb., or slightly over £1 per ton, compared with 27s. 6d. in the preceding year, a fall no doubt largely due to the decline in ocean freights, while from St. Louis, which is now nearer the centre of the wheat belt than Chicago, the rate is put at about 21s. 10d. per ton compared with 28s. 7d. in the preceding year (1900), which had up to then been the lowest recorded figure.

The general reduction in railway rates in the United States since 1880 is well known, but it may be pointed out that there seems to have been a decided decline in the past few years, which, combined with low ocean freights, has largely diminished the cost of transporting grain from the interior of the United States to Liverpool or London, compared, for instance, with a year as recent as 1893.

The charges in the two years are reported to have been as follows:—

		1893. per ton. s. d.	1901. per ton. s. d.
Chicago to New York...	By lake and canal ...	9 10	8 0
	By lake and rail ...	13 1	8 8
	By all rail	22 10	14 0
St. Louis to New York...	By rail	26 7	18 0
St. Louis to New Orleans	By river (in sacks) ...	16 4	9 4
Do.	Do. (in bulk) ...	10 2	6 7
Chicago to Liverpool ...	By rail and s.s.	31 9	20 0
Chicago to London ...	Do.	35 1	21 8
St. Louis to Liverpool :	*Viâ* New Orleans ...	22 10	14 9
St. Louis to Liverpool :	*Viâ* New York	33 9	21 10

So far, then, as concerns the exports from the United States—and it is these exports which largely control prices in this country—it may be said that the advantage which the British farmer enjoys by his proximity to the home market has been further diminished in recent years, and does not now amount to more than from 15s. to 20s. per ton (or 3s. 2d. to 4s. 4d. per quarter) in the case of the bulk of the grain coming through the Atlantic ports.

Little information on this subject is available for other countries, but in the Argentine Republic it would seem that a rate of 10s. to 15s. per ton would cover the railway charges on a large part of the produce, which, added to the freight in 1901, would make, roughly, an average charge to the United Kingdom of something like 25s. per ton.

CO-OPERATIVE BREEDING OF STOCK.

It is well known that the best means of improving stock is by breeding only from superior animals. The cost of pure-bred bulls, &c., from which to breed is, however, beyond the means of the smaller farmers and others possessing only a very few head of cattle, while these cattle are, on the other hand, usually of poor quality, and just the type which stand in most need of improvement. This difficulty is partly met by hiring sires for service, but here again the private owner, if he does not wish to lose by the cost of good animals, is obliged to put the fees at a higher figure than small owners can conveniently afford, even although they may realise fully the advantages to be gained by the employment of pure-bred sires.

Agriculturists can, however, do much in this direction, as in so many others, by adopting a form of co-operation which has proved very successful abroad, and which has, within the past few years, been adopted with equally satisfactory results by two or three agricultural societies in this country. It consists simply in combining for the joint purchase and ownership of pure-bred bulls or other animals, which are then hired out at a very moderate fee among the farmers joining such a combination. Or the improvement of stock may be taken up by any ordinary agricultural society purchasing one or more bulls for the use of its members. If the sires are hired out to persons other than members of the society, at an enhanced fee, the net expense of procuring and keeping the animal is naturally much reduced.

This form of co-operation has now been adopted by at least two English societies,* viz., the Northumberland Agricultural Society and the Leek and District Agricultural and Horticultural Society; and their rules may conveniently be taken as illustrating the practical working of the scheme. The following are the regulations of the Northumberland Agricultural Society for the use of their pure-bred bulls:—

"Inclusive fees to be paid at first service to the party who has charge of the bull:—

"By members of the society ...	4s.	each cow
"By non-members	10s.	"
"By agricultural occupiers whose annual rental does not exceed £50; hinds or shepherds ...	4s.	"

"No cow will be served by any of the society's bulls that has been served by any other bull within six weeks previously.

"The total number of cows that may be served in any one year by any of the society's bulls is limited to 70, of which not more than eight are to be the property of one owner, other than the party who has charge of the bull for the time being.

"The party who keeps a bull has no claim or preference in the purchase of calves.

* The Board are indebted to the Secretaries of these two societies for copies of their rules, and for the other particulars kindly furnished concerning their working.

"No member of the society may have the use of one of these bulls until his annual subscription to the society has been paid."

The bulls are purchased by the society as required. They are kept by farmers in the county, but remain the property of the society. The fees become the property of the person who keeps the bull, to repay him for the trouble and expense to which he is put. Whilst purchasing bulls of good quality and breeding, the society limits the price given for each to thirty guineas, and its experience has been that the loss incurred upon each bull is something like £12 to £14, *i.e.*, the difference between buying and selling to the butcher. So far, no application has been made for a bull of any breed other than Shorthorn.

The Leek and District Society has the use of two pedigree bulls, which the owner has placed in charge of the Agricultural Committee of the Society for the benefit of the members residing within the Leek Parliamentary Division.

The rules of this society are on similar lines to those quoted above, but the fee to ordinary members (subscribing 5s. per annum), and to cottagers or labourers keeping not more than five head of horn stock (and subscribing 2s. 6d. per annum), is 5s. per cow. To non-members the fee is 10s.

Fees are paid at first service; but it is understood that no cow may be served more than twice, as if she does not hold at the second service she is evidently such an uncertain breeder that it is in the interests both of the society and of her owner that she should be left alone.

Other rules in force in the Leek Society are the following:—No cow which has cast her calf shall be served by either of the bulls for a period of three months, under a penalty of five guineas. The person who keeps a bull has free service of the same for his cows, and it is suggested that each bull shall stand for three months at a place.

No limit is laid down by the Leek Society as to the total number of cows which may be served by a bull; nor is it anticipated that any difficulty will arise from the farmer who keeps the bull using it for too many cows, which might be unfair for the other members. Still, it would probably be better, as is done in the Northumberland Society, to place a limit upon the total number of cows to be served.

THE PREPARATION AND USE OF DRIED POTATOES.*

Enquiries have been recently made concerning the preparation and use of dried potatoes in Great Britain. Particulars relating to this subject are not readily accessible, and it has been considered desirable, therefore, to publish the following summary of the information collected by the Imperial Institute with reference to the use of dried potatoes in this and other countries.

Dried vegetables and fruits are employed to a very much greater extent in Germany than in Great Britain, chiefly owing to the fact that supplies of fresh produce cannot be obtained there all the year round as in this country. Desiccated vegetables have become, in fact, a staple article of food in Germany, being regularly supplied to the army and navy, and they are also extensively employed in the mercantile marine and in the German Colonies. With special reference to potatoes, it appears that in Germany one-half of the annual crop, which in 1901 amounted to 48,687,000 metric tons, is consumed directly as human food, and large quantities are also utilised for feeding stock. In these circumstances considerable attention has been devoted to the desiccation of potatoes, thereby enabling them to be stored without loss of nutritive properties for a much longer period than the raw produce, and during recent years great improvements have been effected in the desiccating process.

In America a considerable demand has also arisen for supplies of desiccated vegetables in the various mining districts, and, consequently, their manufacture has been commenced in Canada and the United States. A few years ago large samples of six different varieties, including potatoes, prepared in Ontario, were forwarded to the Imperial Institute and were transmitted to the War Office for trial.

The forms in which dried potatoes are usually prepared are (1) slices or chips, and (2) granules or groats. The former variety does not appear to be prepared in Great Britain,

* Advance copy of an article to appear in the Bulletin of the Imperial Institute, No. 2.

although a quantity is imported in this form from Germany. The amount thus imported cannot be ascertained, however, as the different vegetables are not separately dealt with in the returns. The preparation of dried potatoes in this country is stated to be restricted to the granulated or groat variety, but these are only consumed to a very limited extent at home, being chiefly employed on board ship or in countries where fresh potatoes are not readily obtainable, and also to some extent in the army and navy. The quantity prepared here cannot be definitely ascertained, but it is believed that, owing to the present facilities for preserving vegetables in a fresh condition, the production, which was never very large, is now steadily diminishing. Factories for the preparation of dried potatoes and other vegetables exist in Essex, in Wigtownshire and in Ireland.

The price of the granulated potatoes fluctuates with the cost of the raw material, but a wholesale quotation to the trade, recently given by one of the principal manufacturers, was 30s. per cwt., packed in 56-lb. tins. It may be noted that 3 oz. of the dried potatoes are equivalent to 1 lb. of the fresh vegetable.

When used for human food the dried potatoes are treated with a certain quantity of boiling water, allowed to stand for several minutes in a hot place, and then served as required. In addition to their use as a single vegetable, dried potatoes are also employed as one of the principal ingredients in the mixed vegetables which are largely utilised in a compressed form for military and other expeditions. A largely-used formula for such preparations is as follows:—

Potato	40 per cent.
Carrot	30 "
Cabbage...	10 "
Turnip	10 "
Seasoning herbs (onion, leek, celery, parsley, parsnip, etc.)	10 "

Precise information concerning the methods employed in the preparation of dried vegetables, including potatoes, is not readily obtainable, as manufacturers are very reticent in sup-

plying details regarding the processes they adopt. The following methods of desiccation have been employed for the purpose :—

(1) Desiccation by a rapid current of dry air at the ordinary temperature.
(2) Drying in hot-air chambers.
(3) Drying in heated vacuum evaporators.

Of these the second and third have received most general application.

It is believed that most of the granulated potatoes prepared in this country are manufactured by Edwards' patented process. In the form of slices or chips, dried potatoes are more easily prepared, and the product is stated to keep well. An outline of the process adopted is as follows :—

After washing and peeling, the potatoes are cut into thin slices or strips, and then placed in boiling water, to which some salt has been added, for five to seven minutes. After this treatment the potatoes are dried in chambers at a temperature of 200-212 deg. F. (90-100 deg. C.), the drying being completed in two or three hours. In working upon a large scale the boiling could be advantageously replaced by steaming, in which case the potatoes would probably be first steeped in water with a little salt.

The following description has been given of the process employed in the preparation of the compressed mixed vegetables already alluded to :—

"The vegetables are gathered in the autumn, when they are in their prime, and carefully sorted; then cleaned, washed, peeled, sliced, and slightly steamed. The various manipulations were formerly performed by hand, but all are now done by machinery. The vegetables thus prepared are then dried in kilns and on lattice-work trays by currents of moderately hot dry air, thereby retaining their natural colour, flavour and aroma. This stage of the process requires the greatest care and attention, so as to keep the temperature constantly at the level ascertained by experience to be necessary for each kind of vegetable. The vegetables and herbs are then carefully mixed in the proportions given above, and then compressed to one-eighth of their original bulk (when fresh) by powerful hydraulic pressure into moulds, thus forming square slabs about ¾ in. thick, grooved so as to

be divided into cakes of five rations each, at the rate of 1 oz. per ration, easily separated for convenience of issue. These slabs are then wrapped in paper and packed by machinery into square tins, which are hermetically soldered. Before the lid is soldered down a punch stamps it automatically from the inside with the season of manufacture. When two years appear on this stamp, as '1888-89,' the first is the year of the crop, and the second the year of compression. The tins are now made of bright 'coke' tin-plate of the best quality, it having been found by experience that the vegetables keep much better in this material than in the dull terne-plate formerly used."

The various operations involved in the desiccation of vegetables are nearly all performed by mechanical means. A large number of ingenious machines have been designed for peeling potatoes, apples, &c., and for cutting them into slices, chips or shreds. These are chiefly of American origin, but are now largely manufactured in Germany also. With reference to drying machines, there are a considerable number upon the market at the present time. For use upon a small scale the "Ryder," an American machine, and the "Geisenheim evaporator," which in its latest form is known as the "Gnom (Waas patent) evaporator," appear to have met with general approval. The problem of devising a suitable machine for the desiccation of potatoes has not been entirely solved, however, and quite recently a competition has been opened in Germany, under the auspices of the Agricultural Department, the Alcohol Verein and various Agricultural Societies, in which a series of prizes, amounting to 30,000 marks, are offered for the best potato-drying apparatus. The one condition imposed is that the machine or system shall be capable of desiccating potatoes so that they can be stored in a form suitable for stock feeding until the next year's crop is ready, and at a cost not exceeding 2½d. per centner (110 lb.). Twenty-two competitors have entered the competition, which should result in the production of a thoroughly suitable system for desiccating potatoes. As an indication of the scale upon which some of the different drying processes are worked in Germany, it may be mentioned that the "original Rassmus dryer" is guaranteed to dry 20 tons of

potatoes, beets, beet-leaves, or other wet fodder in 24 hours. It is a vaccum evaporator, which can be worked either with the exhaust steam from a high-pressure engine or with steam direct from a boiler, according to circumstances.

PROGRESS OF AGRICULTURE IN THE UNITED STATES.

It is stated in the Report of the Secretary of the United States Department of Agriculture for 1902 that, in the progress made by the United States in recent years, there has been no more conspicuous feature than the growth of agriculture. According to the reports of the Twelfth Census, the fixed capital of agriculture, comprising the value of the land, buildings and improvements, of implements and machinery, and of live stock, amounted in 1900 to nearly £4,200,000,000, or four times the paid capital invested in manufactures. During that year there were nearly 5,740,000 farms in the United States, with an area of 841,000,000 acres, of which 415,000,000 acres consisted of improved land. These farms had a total value of nearly £3,500,000,000, exclusive of farming implements and live stock, the former of which, together with machinery, amounted to over £150,000,000 in value, and the value of the latter exceeded £625,000,000. In the returns of the last census about 40 million people, or more than half the total population, resided on farms; and of the 29 million comprising the proportion of the population engaged in "gainful" occupations, about 10 million, or more than a third, were returned as employed in agricultural pursuits. The people that work upon the farm outnumber by more than three million persons those who are occupied in the manufacturing and mechanical pursuits.

In 1899, according to the census returns, the produce of American agriculture, including farm animals and their products had an aggregate value of nearly £1,050,000,000.

The crop of maize, which formed the leading item, was valued at £172,500,000. The hay and forage of the census year were

estimated at over £100,000,000; wheat, which ranks next to maize among the cereal crops, gave a return of £77,000,000; while oats were produced to the value of £45,000,000. Cotton, the great crop of the Southern States, was valued at £67,500,000.

Live stock and their products formed an exceedingly important factor in the grand total. The animals sold and slaughtered during the year were valued at over £187,500,000. The several products of the dairy—milk, butter, and cheese—were together estimated at close upon £100,000,000, while poultry and eggs together brought a return of nearly £60,000,000

UNITED STATES IMITATION BUTTER INDUSTRY.

In July, 1902, a law came into force in the United States making the tax on oleomargarine, coloured to resemble butter, 5d. per lb. and ¼d. per lb. on uncoloured.* This has been a very heavy blow to the industry, although during the year more was produced than in any previous year, but the value of the product was considerably reduced. The Chicago factories produced 43,685,000 lb. against 42,945,000 lb. in 1901. The export of oleo fell off by more than 50,000,000 lb., and the export to the United Kingdom shows a steady decrease in the last three years.

Many ways have been tried to evade the law. A sufficient quantity of colouring matter is given with each packet retailed to enable the purchaser to colour according to taste. Palm oil has been used, as it was found that a small quantity was sufficient to colour a large amount of oleo; but the officials have ruled against this, as the palm oil cannot be said to be used as part of the material for making the product, but simply as colouring. Experiments are now being made towards

* The provisions of this law were given in this *Journal* for September and December last, Vol. IX. pp. 251 and 393.

producing a natural yellow oleo by keeping the yellowest fat separate.

The exports of butter show a great falling-off during the year. The law taxing oleomargarine also contained provisions as to the manufacture and handling of "process" or "renovated" butter. This is butter bought in the country, and practically unsaleable owing to colour, salting or keeping quality, which is melted, cleansed and rechurned. A large quantity of this is exported and sold as "1s. butter."

[*Foreign Office Report, Annual Series*, 1903, *No.* 2,952.]

THE BUTTER INDUSTRY IN SIBERIA.

Mr. Henry Cooke, H.M. Commercial Agent in Russia, has recently supplied to the Foreign Office a Report on the trade of Siberia. He states that the completion of the western section of the Trans-Siberian Railway has, among other results, produced an extremely rapid increase in the exportation of butter, chiefly owing to the continually growing demand for this product in the United Kingdom. Numerous Danish and German, and some British, offices engaged in this trade are already established in various centres. Dating only from 1894, previous to which no butter whatever was produced for export, and commencing in the neighbourhood of Kourgan, the industry has spread to Omsk, Kainsk, Novo-Nikolaievsk, Barnoul, Biisk, and Minussinsk; and it is now the main resource of the peasant population of these districts. The establishment of peasant associations and societies, and the superior enterprise and modern improvements of the export firms, foreign and Russian, which have settled in the country itself, have greatly improved the conditions of production.

The United Kingdom and Denmark are the principal centres of demand, but the Siberian product is also met with so far east as Dalny and Port Arthur, and even in China and Japan. Through the establishment of direct communication *viâ* Riga, Siberian

butter now reaches the London market direct, and not under Danish marks or *viâ* Denmark only. The butter is brought to the nearest railway transit points either by cart or river, and is packed for export in beech casks of foreign make. The Government is doing all in its power to facilitate carriage arrangements to the Baltic ports, and to multiply cold storage conveniences *en route*.

Prices are usually settled by arrangement for the whole year, or for at least nine months, between the export offices and the peasant producers (whether associations, societies, &c.), who meet in January at Kourgan for this purpose. Outside purchases are settled according to current market prices, during the first nine months by London, Copenhagen, and other foreign quotations, and from October to December by those of St. Petersburg and Moscow. Prices at the nearest market range from 19s. to 22s. per 36 lb. in the Government of Tobolsk; and from 20s. to 24s. in that of Tomsk.

Mr. Cooke remarks that the progress made in this new industry may have its negative side, as complaints are constantly being made that the peasantry, in their eagerness to dispose of all their available supplies of milk to the export offices, are unduly sacrificing the regular nourishment of their children. It is, however, rejoined that the increased earnings should so react on their general welfare as to enable them to provide for their own families as well.

The following table shows how rapidly this industry has advanced during the last few years:—

Year.	Number of Establishments.	Production for Export.	
		Pouds.	Lb.
1898	140	150,000	5,416,800
1899	334	300,000	10,833,600
1900	1,107	1,100,000	39,723,200
1901	1,800	1,860,000	67,168,320
1902	2,500	2,500,000*	90,280,000

* Estimated.

The Report explains that the number of establishments in 1902 was only 2,000 according to unofficial sources, but the

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discrepancy is probably due to the laxity of the terms employed, as some of the establishments hardly merit the designation of buttery, creamery, dairy, &c.

[*Foreign Office Report, Miscellaneous Series, No.* 585. *Price* 2*d.*]

PORK AND BACON CURING INDUSTRY OF BELGRADE.

The Board have received through the Foreign Office the following account of the pork and bacon industry in Servia, which has been drawn up by H.M. Vice-Consul at Belgrade.

Though Servia has always been an agricultural country, the farmers and peasant proprietors were for a long time content to supply their own wants and those of the neighbouring towns without making any special effort to obtain a footing in foreign markets. Although one of their principal sources of income lay in the large herds of swine, which may be seen all over the country, the possibilities of that useful animal as a trade resource were neglected. Little attention was paid to pig breeding and none to fattening pigs for the market. When opportunity occurred, or a pig owner was in need of money, a certain number of gaunt miserable-looking animals were driven in from the woods to be exported to Austria-Hungary. Prices were naturally low, and the purchaser would at the same time buy up considerable quantities of maize, which was to be had cheaper in Servia than in his own country. Transporting both across the river to Hungary, he then proceeded to fatten up Servian swine on the produce of Servian fields, retailing the fattened article at a very considerable profit. This business proving remunerative, it increased by degrees to such an extent that it aroused the interest of Servian business men, who failed to see why an undertaking carried on entirely by means of Servian produce should not be exploited for the benefit of their own country instead of going into the hands of foreigners. The result was the founding in 1896 of a company for the export of Servian meat and, indirectly, to induce the farmers to pay more attention to the breeding of their stock ; and it was owing to the action of this association that a law was passed prohibiting the export of live pigs to Austria-Hungary under the weight of

2½ cwt. For two years the company carried on their business at Nisch, while buildings were being erected for them at Belgrade on land presented by the King. Finished in 1898, these buildings, situated on the banks of the Danube, in close proximity to the town, and connected by a branch line with the railway station, offer every facility for the import of live stock and the export of their goods. Electric light is laid on all over the buildings, with a plentiful supply of water.

Until 1901 the export trade was in fresh meat, poultry and eggs, but in the same year a further step in advance was taken by this association, who provided and leased to a Danish company a building for the salting and curing of pork and bacon. Later on a building was leased to a French company on the same lines, and the export of bacon, hams and pork became in a short time not only the largest industry of Servia but one which promised soon to have a very large trade connection with Europe in general.

Before going further it would be as well to explain the footing on which these companies stand in regard to each other. The company, which is prohibited by its statutes from trading on its own account or from entering into any business of a speculative character, is the mainspring of the whole concern. It owns and leases out the various buildings, provides light and water, maintains pens for the live stock, and keeps the records of animals killed and the quantity and value of the exports; it purchases no animals on its own account, but slaughters and prepares them for the branch companies, who are then free to carry on their own business in any way that seems best to them.

The pens may be hired by anyone, and no obligation is implied as to further dealings with the company, so that peasants desirous of selling their stock may bring and keep them here until they have enquired into the state of the different markets and agreed upon what course of action may be most profitable to themselves. They are kept in excellent order and are provided with sheds and open yards, the larger capable of holding 120 to 130 and the smaller 60 to 70 animals. The charges are very moderate; for one month the larger may be hired at 2s. 5d. a day and the smaller for 1s. 2½d., while for longer periods the prices are still more reduced.

The owner of the stock provides the necessary service and food, though the company are under the obligation always to have a sufficiency of maize meal on hand.

The veterinary inspection, which is obligatory on the arrival of the animals, at the owner's expense, costs 1s. 7d. for fifty head and 2 paras a head, or one penny, for every five over that number. The fee for a *post-mortem* examination is 1s. 7d.

From the selection offered by these pens the curing companies purchase their stock. Pigs are purchased by weight in the following way. The total live weight of the number of pigs required is taken and 49½ lb. per head is subtracted from the total weight; this obtained, 4 per cent. is again struck off, the remainder being the weight paid for according to quality at so much per kilo.

The animals thus purchased are driven up a long covered gallery to the second floor of the abattoir, where they are killed and slung up by the hind leg to an overhead rail to pass down an inclined plane, through the hot water tanks and usual processes, to the first floor, where they are cleaned before going on to the cooling and storage rooms. The carcases are then handed over to the purchasing company to be salted and prepared. This is done by means of perforated needles, through which the brine is forced by a hand pump; the carcases are then placed in heaps, either on the floor of the salting room or in specially prepared tanks, where they lie covered with dry salt for some eight days, when they are packed and loaded on the railway trucks drawn up on sidings at the door of the warehouses.

The following table shows the number of pigs killed and the weight, in cwt., of the pork and bacon exported during 1901:—

1901.

DESTINATION.	NUMBER.	WEIGHT.
		Cwt.
Vienna	13.756	23,490
England	16,120	19,750
France...	13,404	22,320
Total	43,280	65,560

A considerable trade is also done in lard, which is for the most part exported to Germany. In 1901, 8,481 cwt. of lard, valued at £20,000, were prepared and exported.

The experiment is also being tried of sending fresh mutton to England, and in November, 1902, some 2,000 carcases a week were being despatched for the English market. It remains to be seen whether this venture will meet with success, but Servian sheep are, on the whole, small, and generally poor in condition, and can hardly compare with English or Australian meat. Beef in smaller quantities is also exported to Austria-Hungary.

The figures regarding the quantity and value of meat of all kinds exported for the past four years are :—

YEAR.	QUANTITY.	VALUE.
	Cwt.	£
1898	28,040	44,160
1899	41,190	66,800
1900	66,710	128,000
1901	118,350	216,800

The figures for 1902 are not yet obtainable, but it is certain that they will show a considerable increase on those of past years.

Another important and growing branch of the business is the export of eggs and poultry, alive and dead.

Though the figures for 1901 as regards the export of dead poultry are not to be had, owing to their inclusion under the general heading of meat, the numbers are said to surpass the total of former years. The value of eggs exported is also worth

Poultry Exported.

YEAR.	DEAD.	ALIVE.
	£	£
1898	20,120	16,320
1899	27,000	26,400
1900	24 000	39,000
1901	—	55,200

noting. In 1898 it was only £1,400, which increased yearly until in 1901 the value was raised to £33,880, with every prospect

of a further advance. In November, 1902, four waggons, containing 1,110 cases of eggs, were sent to London, and at the end of the same month large quantities of poultry were being prepared for the London Christmas market. How far these will prove to be up to the English standard remains to be seen, but the increased demand for good poultry will, it is stated, induce the peasants to pay more attention to the breeding and fattening of their geese and hens than is done at present.

A great improvement is reported to have taken place already in the quality of the swine sent to Belgrade, and this has been greatly furthered by the action taken by the association, some two years back, in importing and distributing among the farmers over two hundred pigs of the Yorkshire breed. Various Government establishments throughout the country are also working to the same end by introducing new breeds of sheep and pigs, in order to find out what kinds are best suited to the country.

The Danish company exports principally whole or half carcases, boned or unboned, for the English and Danish markets; while the French company is engaged more in preparing hams, sides, and flitches of bacon, which are despatched for the most part to France and her colonies.

DEVELOPMENT OF THE DAIRYING INDUSTRY IN ARGENTINA.

The Board have recently received through the Foreign Office a copy of a despatch from Mr. F. D. Harford, of H. M. Legation at Buenos Ayres, relating to the recent development of dairy produce in the Argentine Republic.

Mr. Harford states that this development is one of the most remarkable features in connection with the laying down to lucerne of vast tracts of rich land. Until recent years both milk and butter were inferior and difficult to obtain; but numerous creameries and factories have now been started, and

there seems to be no reason why the export of butter should not equal or surpass that of any other country in the world. The quality is indicated by the fact that the price obtained for Argentine butter in London was in 1902 lower than that of Danish and Swedish butter only. Butter is being exported in increasing quantities both to Great Britain and South Africa, and threatens the French, Irish, and Danish butter now largely used in Brazil. The export of butter in 1902 is given as 4,103 tons, an increase of 180 per cent. over the quantity in 1901, which was itself double the amount exported in 1900.

Mr. Harford was informed that there is much land, which will only carry 300 cattle per square league (6,600 acres), that will carry 3,000 when laid down to lucerne ; two crops of wheat being first taken off, after which the lucerne, if not permanent, will yield three or four crops a year for some twenty years without re-sowing.

A dairy show is annually held at Buenos Ayres, and very fair cheese is also exhibited.

FARM BOOK-KEEPING IN GERMANY.

The book-keeping department of the German Agricultural Society (Deutsche Landwirtschafts-Gesellschaft) has for its object the furthering of agricultural book-keeping in general, and in particular the assisting of the members of the society with the keeping of their farm accounts and books. These objects it attains in a variety of ways, viz. :—

1. By the preparation and distribution of the most suitable forms for the several farm accounts, *e.g.*, cash book, wages book, as well as by the issue of books describing in detail the system of book-keeping recommended by the department. The first edition of these books,* which was issued in 1896 on the opening

* *Landwirtschaftliche Buchführung, Teil I. und II.*, von Dr. Aereboe. Price, 2s. each.

of the department, was exhausted within six months, but, to put the suitability of the forms and system recommended to the test of further practical experience, an interval of a year was allowed to elapse before the issue of the second edition. In 1898, before the department was two years old, its books were in full use on one hundred farms, and on a much greater number they were used as supplementary to the previously-kept books.

2. By inspection of farms' books with a view to checking their accuracy.

3. By keeping the farm books at the offices of the department in Berlin, on the basis of a weekly report from the farmer.

4. By giving information concerning rates and taxes.

5. By acting as arbitrators in matters of dispute on farms.

6. By giving courses of instruction in agricultural book-keeping at suitable centres.

7. By giving advice, either verbal or written, and assistance on all matter relating to the above.

Recently the book-keeping department has undertaken to obtain expert advice for farmers in cases where their farms are yielding unsatisfactory profits. This it does by arranging for an inspection of the farm, once or oftener as necessary, by some well-known and skilled agriculturist, who endeavours to point out the causes of the failure and to suggest improvements. In the selection of an adviser great care is taken to obtain one who has had ample experience of, and may be regarded as a specialist in, the kind of farming on which he is asked to advise.

All officers of the department are, of course, bound to the strictest secrecy regarding any information they may obtain about the farms on which they give assistance.

DUTY ON ANIMALS IMPORTED INTO THE UNITED STATES.

The Board have received through the Foreign Office a copy of an Act passed by the United States Legislature in March last, which modifies the law regarding the duty on animals

imported for breeding purposes as laid down in the decision by the Board of General Appraisers referred to on p. 541 of the last issue of this *Journal.*

The Act provides that any animal imported by a citizen of the United States specially for breeding purposes shall be admitted free of duty, whether intended to be so used by the importer himself or for sale for such purpose. No animal will, however, be admitted free unless pure bred of a recognised breed and duly registered in the books of record established for that purpose; and a certificate of such record and of the pedigree of such animal must be produced and submitted to the Customs officer, duly authenticated by the proper custodian of such book of record, together with the affidavit of the owner, agent, or importer that such animal is the identical animal described in the said certificate of record and pedigree. Regulations issued by the Treasury Department in pursuance of the powers vested in them by the Act contain a list of registers which will be recognised as books of record for the purposes of this Act, a form of certificate of record and pedigree to be used for imported animals, and certain rules to be observed for the enforcement of the Act.

GEOLOGY OF DUBLIN AND LEICESTER.

Among the Memoirs recently published in connection with the Geological Survey are two dealing with the geology of the Dublin and Leicester districts, respectively.

The first-named Memoir has been prepared to accompany and explain the new colour-printed drift-map of Dublin and its environs. The description given of the "solid" rocks is mainly reprinted from the original "Memoir to accompany Sheets 102 and 112" which has long been out of print, but this part has been expanded to include a summary of the researches carried out by private workers and by the Survey since that Memoir was published, and a newly-written portion dealing with the "Petrography" of these rocks has also been added.

The description of the glacial drifts and other superficial deposits is altogether new, and contains the information collected during the survey of these deposits during the year 1901. The material under the heading of "Economic Geology" has been greatly enlarged from the previous Memoir, and now includes a list of the minerals of the district, and an account of researches into the character of its soils. The previous geological literature of the neighbourhood is also for the first time discussed, under the heading of "Bibliography," and a list of this literature is given in an appendix. The Memoir is illustrated by five plates from photographs and by twenty-one figures in the text.

The "Memoir of the Geology of the Country near Leicester" contains a full account of the geology of Leicester and the adjacent country northwards as far as the important granite quarries of Mount Sorrel, and eastwards into the borders of Rutland. The district is essentially a clay country, being largely Keuper marls, Lias clays, and Boulder clay. The drift deposits cover the larger part of the area, and their importance from an agricultural point of view is evident. Records of boring and well-sections are given, and there is a full list of fossils from the Trias, Rhaetic and Lias formations. The colour-printed drift map, Sheet 156, which accompanies this Memoir, has attached to it a section showing the general structure of the country.

Copies of the Memoirs, price 3s. each, or of the maps, price 1s. 6d. each, may be obtained from any agent for the sale of Ordnance Survey maps, or directly or through any bookseller, from the Ordnance Survey Offices, Dublin or Southampton.

Fruit Culture in Nova Scotia.

The fruit crop of Nova Scotia in 1902 was deficient both in quality and quantity, and prices were not excessively high. It is stated that many thousands of young trees are nevertheless being planted each year. In counties outside the fruit belt, model orchards are being planted; these orchards now number

fourteen, in as many different counties. Cranberries have become of considerable importance in this Province. This crop was last year much injured by frost before ripening, but sufficient is known of it in various parts of the Province to encourage farmers to persevere, inasmuch as the waste bogs where this fruit is grown are not suitable for any other purpose.

[*Annual Report of the Secretary of Agriculture for Nova Scotia*, 1902.]

Co-operative Dairies in Denmark.

From a statement published in a recent number of the *Tidskrift fur Landokonomi*, it appears that there are now 1,057 co-operative dairies in Denmark, with an estimated capital of nearly £1,400,000.

New Zealand Sheep Statistics.

"The annual sheep returns" for the year ending April 30th, 1902, issued by the Government of New Zealand, shows that the number of sheep in the colony on that date was 20,342,727, an increase of 109,628 as compared with the previous year. The number of owners was 18,803, of whom 7,035 owned less than 200 sheep, while 131 owners had over 20,000 sheep.

Agricultural Exhibition at Winterswijk.

The Board of Agriculture have received information through the Foreign Office that an International Agricultural Exhibition will be held by the Gelderland Overijssel Agricultural Society at Winterswijk, Province of Gelderland, Holland, on September 9th, 10th, and 11th, 1903. The Exhibition will comprise live stock, agricultural products,

machinery and implements, &c. The Secretaries of the Exhibition Committee are C. H. F. A. Corbelijn Battaerd, at Groenlo, and S. Snijder, at Winterswijk.

Creameries in Norway.

The United States Bureau of Foreign Commerce has recently issued a report containing information relating to creameries in various foreign countries. The total number of creameries in Norway is about 650. Their production of butter and cheese in 1901 amounted to 7,716,000 lb. and 9,123,000 lb. respectively, and the quantity of milk employed daily was about 220,000 gallons. Nearly all the creameries are co-operative, but some are rented by the shareholders to individuals or corporations at a fixed annual payment. Most of the establishments are provided with separators and other modern equipments, and the butter is partly sold on the English market. The few cheese dairies in Norway "have not yet succeeded in producing cheese which satisfies the demand of foreign markets." There are three milk-condensing factories, and they export nearly all their output.

Inspection of Meat Exported from Holland.

According to information received through the Foreign Office, the Netherlands Government have recently passed a decree providing that, as far as possible, everyone intending to export the meat of ruminants or pigs from that country, may, if his slaughter-house is so arranged and situated that inspection may properly be made, have the meat inspected by a Government Inspector, who will mark such of the meat as is found fit for export with a Government mark. Regulations which have been issued under the Decree require

that the meat shall be submitted for inspection in pieces not smaller than half carcases. In the case of beef, veal, and pork, certain specified parts must always accompany the meat and be submitted for inspection in their natural condition; but in the case of mutton, it is only necessary to submit the organs and parts in such cases and in so far as the Inspector shall direct. The regulations also enumerate the circumstances in which the Inspectors may, as well as those in which they must, refuse to pass the meat.

Timber Resources of Maine.

The necessity of the preservation, development and economical management of the timber lands in Maine is now being fully recognised by the inhabitants of that State. Of the 31,500 square miles in the State some 21,000 square miles consist of forest, of which 9,471,050 acres are taxed as wholly wild land, while it is estimated that the total area of lumber-producing land is from 11 to 12 million acres. A superficial survey made by the authorities indicates that there are standing, roughly, 21 billion feet of spruce, in addition to other varieties of timber, with an annual growth which is considered capable of yielding 637 million feet of spruce timber each year without depleting the supply. Much of the lumber is being used for the manufacture of pulp and paper. A large proportion of the lumber wealth of the State is derived from the white birch forests, from which upwards of 35 million feet are taken annually.

[*Foreign Office Reports, Annual Series, No.* 2,967.]

Departmental Committee on Highways.

The Local Government Board have appointed a Departmental Committee to inquire into the general condition and sufficiency of the roads of England and Wales, and to report whether any, and, if so, what, amendment of the law relating to these matters or its administration is desirable in view of the various purposes for which the roads now are or shortly may

be utilised; and particularly whether any change of the authorities who have control over the roads or of their powers is required.

United States Cattle Import Regulations.

The Board have received information through the Foreign Office that the operation of Section 25 of the Act of July 24, 1897, prohibiting the importation of neat cattle from any foreign country into the United States, has been suspended, so far as regards importations from Norway, Sweden, Great Britain, Ireland, the Channel Islands, and the countries of North, Central, and South America, including Mexico. The importation of such cattle from these countries will be allowed under sanitary regulations promulgated by the Treasury Department.

These regulations in the case of animals from the United Kingdom are to the following effect:—Horses are required to pass a veterinary inspection at the port of entry, and if any are found to be infected with any contagious disease, they will be isolated, and may not be allowed to land. Cattle, sheep, and other ruminants must be accompanied with a certificate from the local authority of the district in which the animals have been for one year prior to the date of shipment, stating that no contagious pleuro-pneumonia, foot-and-mouth disease, anthrax, rinderpest, or any other disease contagious to cattle, has existed in the district during the year. Swine must be accompanied with a similar certificate relating to the existence of foot-and-mouth disease, hog cholera, swine plague, and erysipelas. Imported animals must also be accompanied with an affidavit by the owner, stating that the animals have been in the district where purchased for one year next preceding the date of sale, and that no contagious disease affecting the species has existed among them, nor among any animals of the kind with which they have come in contact, for one year last past, and that no inoculation has been practised among the animals for the past

two years. The importer or his agent supervising the shipment must also send an affidavit stating that the animals have not passed through any district infected with contagious disease affecting that kind of animal; that they have not been exposed in any possible manner to the contagion of any of the said contagious diseases, and that the animals, when not driven, have been shipped in clean and disinfected cars and vessels direct from the farm where purchased. The foregoing certificate and affidavits must accompany the animals and be presented to the collector of customs at the port of entry. The period of quarantine for cattle imported from Great Britain, Ireland, and the Channel Islands, is sixty days, counting from the date of shipment. Cattle over six months old are to be tested with tuberculin by a United States' inspector stationed in Great Britain, or after arrival at the animal quarantine station at the port of entry. All cattle so tested which show a reaction will be prohibited from entry into the United States, and otherwise disposed of. Cattle imported into the United States directly from the islands of Jersey and Guernsey may be admitted without being tested with tuberculin. Persons who desire to have animals tested should apply to Dr. T. A. Geddes, care of United States Consul-General's Office, London.

Live Stock for Jamaica.

During the past twelve months, Messrs. Elder, Dempster & Co. have carried pedigree stock from Avonmouth to Kingston, Jamaica, freight free, and are prepared to extend the same facility during June, July, and August, 1903, to shippers of stock for breeding purposes in Jamaica.

HARVEST AND CROP REPORTS

CROPS IN RUSSIA.

The Central Statistical Committee of the Russian Ministry of the Interior has published the following returns of the *acreage and production of the principal crops in the Russian* Empire (72 provinces) in 1902 :—

Crop	Area.	Production.
	Acres.	Quarters.
Rye	73,941,460	106,884,022
Wheat	55,118,210	75,684,090
Oats	43,173,780	95,156,065
Barley	21,721,543	40,463,334
Spelt	974,759	1,072,860
Buckwheat	5,838,780	6,110,377
		Tons.
Potatoes	9,826,148	27,801,611

CROPS IN BELGIUM.

The Agricultural Returns of Belgium give the following as the area and production of the principal crops in that country for the year 1901, viz :—

Crop.	Area.	Production.	Yield per Acre.
	Acres.	Bushels.	Bushels.
Wheat	409,479	14,138,851	34·5
Rye	620,187	19,770,075	31·9
Barley	94,586	4,654,517	49·2
Oats	615,586	33,274,783	54·1
		Tons.	Tons.
Potatoes	356,369	2,706,789	7·6

The area under flax is returned at 49,934 acres.

ARGENTINE MAIZE CROP.

According to information received through the Foreign Office, the area sown with maize in the Argentine Republic this year is about 4,363,000 acres. There appears to be a fair prospect of a good crop, both as regards quantity and quality, and it is estimated that the total yield is likely to amount to about 3,657,000 tons.

THE GERMAN HARVEST OF 1902.

The annual statistics relating to the principal crops in Germany, which have now been published for the year 1902, are shown in the following table, together with the figures for the previous year:—

Crops.	Area.		Total Yield.		Average Yield per Acre.	
	1902.	1901.	1902.	1901.	1902.	1901.
	Acres.	Acres.	Qrs.	Qrs.	Qrs.	Qrs.
Wheat	4,723,171	3,906,107	17,909,319	11,473,891	3·79	2·94
Rye	15,201,726	14,355,978	43,593,972	37,480,214	2·87	2·61
Barley	4,060,742	4,592,385	17,082,251	18,299,272	4·21	3·98
Oats	10,266,036	10,896,188	52,749,420	49,803,004	5·14	4·57
			Tons.	Tons.	Tons.	Tons.
Potatoes ...	8,004,225	8,197,515	42,763,890	47,904,787	5·34	5·84
Clover (hay) ...	4,753,740	4,456,715	9,493,989	6,655,094	2·00	1·49
Lucerne (hay) ...	559,497	550,306	1,320,061	1,152,375	2·36	2·09
Permanent Grass (for hay)	14,695,347	14,682,898	25,598,951	22,010,528	1·74	1·50

PARLIAMENTARY PUBLICATIONS.

Board of Agriculture.—Agricultural Statistics, 1902. [*Cd.* 1616.] *Price* 1*s.* 5*d.*

The annual volume hitherto known as the *Agricultural Returns* is now issued under the general title of *Agricultural Statistics*, 1902. The agricultural returns of Great Britain, properly so-called, are published in two sections, the tables relating to acreage and live stock, with remarks on the features of the year, having been issued in October, and the full details of the produce of crops, with similar comments, in February. In each case a preliminary statement, comprising only the total figures, was issued some two months earlier.* The present volume contains, in addition to these, full particulars of British agriculture, a large number of tables embodying details of the prices of corn and other agricultural produce, the weather of the British Isles, the supply of cattle, sheep and pigs at the principal markets of the country, the imports and exports of agricultural produce, and the latest available statistics relating to Colonial and foreign agriculture.

In his "General Report on the Statistics," Major Craigie states that the returns of acreage and live stock were compiled from 513,489 separate schedules, and 10,360 supplementary returns from owners of live stock. Resort to estimates was only necessary in less than 3 per cent. of the total number of individual returns.

The total area of land and water in Great Britain stands at 56,786,000 acres, of which 12,884,000 are mountain and heath land used for grazing stock, 32,388,000 acres were under crops and grass, and 2,726,000 were occupied by woods and plantations, according to the return of 1895.

The report on the weather conditions and crop results of the

* See *Journal*, Vol. IX., No. 2, p. 202; No. 3, p. 332.

year is followed by a diagram showing the variations in the estimated produce of wheat in Great Britain since official statistics of the yield of crops were first collected, the fluctuations in the acreage and average yield per acre being also indicated.

The returns of the numbers of live stock indicate a general decrease between 1901 and 1902 among horses, cattle and sheep; pigs, on the contrary, showing an increase. The recent reductions in the numbers of cattle and sheep having directed special notice to the position of the live stock interest in Great Britain, the fluctuations in the numbers and distribution of the herds and flocks of the country have been made the subject of a much wider comparison, contrasting the present position with that of thirty years ago. A new table is introduced giving the figures and at pages XV. and XVI. two coloured maps are given for cattle and sheep respectively, graphically showing the percentage increases and decreases in each county during the period from 1870-2 to 1900-2.

The prices of corn in 1902 are given in detail for each of the markets scheduled under the Corn Returns Act, 1882, and the averages for England and Wales are tabulated for a long series of years. The average prices for wheat and barley last year were the highest recorded since 1898, while in the case of oats it is necessary to go back to 1885 to find a higher annual figure.

The course of prices of live stock at certain markets in Great Britain as returned under the Markets and Fairs (Weighing of Cattle) Act, 1891, during the past five years is illustrated by a diagram, and the substantial character of the rise which occurred in the price of fat cattle during the second quarter of 1902 is clearly indicated. To the diminution in the imports of live cattle and fresh beef from the United States is ascribed the improved prices secured in Great Britain during a portion of the year.

Complete statistics relating to the imports and exports of agricultural produce are again included in the volume. They show a considerable and unusual diminution in the receipts of live animals and dead meat, mainly due to the reduced supplies from the United States. The reduction in the number of cattle

imported would have been more seriously felt had it not been for the increased supplies of chilled and frozen beef from Argentina.

The relative proportions of the supplies of wheat and wheat flour from British Possessions and foreign countries are concisely shown, the total quantity of wheat and flour expressed as wheat imported in the past year being greater than any previously recorded, amounting to 5,396,000 cwt., and of this 1,272,000 cwt., or nearly one-fourth, came from British Possessions, Canada now taking the second place as a source of supply to the United Kingdom.

The information relating to Colonial and foreign agriculture has been brought down to the latest possible date, although figures for 1902 are available in comparatively few instances. A comparison of the yield per acre of the cereal crops of foreign countries with those of the United Kingdom shows that this country, with an average yield of 31 bushels of wheat per acre for the years 1897–1901, has distanced any European competitor, and has still more exceeded the yield of the wheat areas of the United States over the same period, which was but little more than 13 bushels per acre.

The latest estimates place the numbers of cattle in the United States at 61,764,000 head, a figure considerably below the 67,800,000 head suggested as the census total. In sheep the new figures indicate a larger increase in the latest year, while the estimated numbers of swine appear to have declined by nearly two millions.

It would appear that while the twelfth census of the United States was more comprehensive in the scope of its enquiries than any of its predecessors, this fact necessarily involves difficulties in comparing its results with those of earlier years. Nevertheless, the tentative comparison of the census volumes is quoted as indicating approximately the movement in the live stock industry of the United States over six successive decades. The differences between these census figures and those which appear in the tables constructed from data supplied by the Agricultural Department of the United States illustrate, it is pointed out, the inconvenience of having in a single State varying systems of enumerating agricultural facts. Major

Craigie, in conclusion, repeats the caution which he has from time to time suggested against making too confident comparisons with foreign data, and refers to the further efforts made by the International Statistical Institute to secure greater uniformity in the practice of different countries in collecting agricultural statistics.

Board of Agriculture.—Annual Report of Proceedings of the Land Division under the Tithe and other Acts for the year 1902, *with Summary of the Powers and Duties of the Board.* [*Cd.* 1519.] *Price* 8*d.*

The annual statement of completed transactions effected by the Land Division of the Board, under a variety of important statutes, which has hitherto appeared under the above title, has been on this occasion very notably expanded into a general review of the historical, statistical, and legal aspects of the functions of the Tithe, Copyhold and Inclosure Commissions—executive bodies whose powers were first merged in 1882 in those of the Land Commission, and ultimately in 1889 entrusted to the Board of Agriculture.

It has been thought desirable to bring together in the general report of the Assistant Secretary in charge of the division, information as to the facilities which the Board is in a position to offer in these matters to those concerned in the ownership and management of land, and to supplement these new features of the publication by a detailed summary prepared by the Legal Adviser of the Board, setting forth succinctly the statutory functions of the Board under the separate Acts. The forms of procedure prescribed for making use of the Board's intervention in these matters are also brought to the notice of those interested by reprinting in the Appendix to the General Report the more important of the several series of instructions now in force for expediting the orderly transaction of the necessary business under each head.

The magnitude of the financial operations involved in the proceedings under the Tithe Acts is illustrated by the statistics now furnished as to the sum of over £4,000,000 originally apportioned under the commutation arrangements of 1836, and the several modifications since introduced. An interesting record of the origin of the Board's powers in matters of commons inclosure and regulation furnishes an introduction to the account given of the administrative measures year by year required in this connection. The history of the growth of the Board's work in connection with the charging of estates for improvements and works is followed by a full tabular analysis of the different heads of improvements under which the £17,465,000 so charged has been expended. This exhibits the changing proportions of particular classes of outlay from 1847 to the present time.

The total number of applications to the Board in 1902 under the various Tithes Acts was 1,037, as compared with 1,142 in 1901. The number of transactions under these Acts completed during the year was 1,049. This total included 306 alterations of apportionments, 593 redemptions, and 109 mergers, the fees received in respect of these transactions amounting to £4,044. At the close of the year 960 cases were in progress, whereof 223 were altered apportionments, 668 redemptions, and 23 mergers.

The total number of enfranchisements completed by the Board in 1902 under the Copyhold Act was 297, as compared with 293 in 1901, 233 being under the compulsory and 64 under the voluntary provisions of the Act.

The total number of applications made to the Board in 1902 for their sanction under the Drainage and Improvement of Land Acts to expenditure for the improvement of land was 212, as compared with 238 in 1901. The aggregate sum represented in these applications was £144,703, as compared with the exceptionally large applications of £301,318 submitted in 1901. The actual expenditure on completed works for which charges on estates have been created during the past year was £138,195. This total included £54,438 for farm buildings, £29,604 for additions and improvements to mansion houses or other residences, and £22,612 on account of labourers' cottages. The

expenditure under this last head is the largest charge for the improvement of labourers' cottages for any year since 1885.

The work of the Board under the Universities and College Estates Acts, under which it appears over £9,000,000 worth of transactions have now been completed, involved 149 applications in 1902 for their consent to sales, purchases, and exchanges of property, to improvement loans, and to other transactions under these statutes, as against 176 in 1901.

Ninety-three applications were made under the Glebe Lands Act, 1888, for the Board's approval of the sale of 3,139 acres. The sales completed in the past year were 110 in number, comprising 2,753 acres, for which £98,450 was paid.

Under the Agricultural Holdings Act, 1900, umpires were appointed by the Board during the year 1902 in England in 15 cases, and single arbitrators in 13 cases. In Scotland arbiters were appointed in 7 cases, while the Board in 65 cases in England and in 15 cases in Scotland exercised their power of extending the time for making the award.

Board of Agriculture.—Annual Report of Proceedings under the Sale of Food and Drugs Acts, Merchandise Marks Acts, &c., for 1902. [*Cd.* 1611.] *Price* 5*d.*

This Report deals with the work carried on by the Intelligence Division of the Board during the year 1902.

The Inspectors of the Board have continued to keep closely in touch with the officers responsible for the execution of the Sale of Food and Drugs Acts in the districts of the various local authorities under these Acts. The Inspectors also visited the premises of over 800 manufacturers of and wholesale dealers in margarine and margarine cheese, and examined the registers of sales kept in accordance with the requirements of Section 7 of the Act of 1899. During the year further notifications were received by the Board from 63 Local Authorities of the registration of 207 such premises under Section 7 of the Act.

According to the returns furnished to the end of December, 1902, the total number of premises registered under this Section is 2,930.

In the early part of the year the Board instituted proceedings under the Merchandise Marks Acts in the case of 21 fraudulent sales of hams, the evidence in each case being furnished by the Bacon Curers' Association of Great Britain and Ireland. In connection with these proceedings 38 persons were prosecuted, of whom 30 were convicted; seven persons were acquitted, and in one case, in which the principal and assistant were charged, the assistant could not be traced.

The returns received from District Agricultural Analysts under the Fertilisers and Feeding Stuffs Act, 1893, show that in 1902 samples were analysed in 65 counties and boroughs of Great Britain, as against 60 in 1901, and 58 in 1900. There was a considerable increase in the total number of samples analysed, which amounted to 1,300, as compared with 1,068 in 1901, and 974 in 1900.

In consequence of representations addressed to the Department by the Biggleswade Trades and Agricultural Association as to the serious effects of the Dutch competition on the brined vegetable industry in this country, an enquiry was made by the Intelligence Division of the Board into the conditions under which the export trade in brined vegetables is carried on in the Netherlands. The results of these investigations were presented to both Houses of Parliament, and have been issued as a Parliamentary publication. [Cd. 1368. Price 8d.]

Numerous complaints have been addressed to the Board on such subjects as excessive railway rates on agricultural produce; the rates charged for the carriage of rams in crates; preferential rates for imported produce; and the application of the Weights and Measures Acts to railway milk churns when used as measures. Inquiries have been made by the Board in all these cases, and representations have been made by them to the Board of Trade or the railway companies concerned in instances where such a course seemed desirable.

Information interesting to agriculturists was disseminated by means of special reports, the *Journal*, and leaflets. The total number of leaflets issued in 1902 was about 398,900.

Agricultural Statistics, Ireland, 1902. [*Cd.* 1522.] *Price* 1*s*. 5*d*.

This publication contains returns of the prices of certain classes of agricultural products and live stock in Ireland during the year 1902, with comparative tables for the preceding years since 1883.

The following table gives the average prices of Irish produce for the past three years :—

Commodities.		1900.			1901.			1902.		
		£	s.	d.	£	s.	d.	£	s.	d.
Wheat	per cwt.	0	6	4¼	0	6	4¾	0	6	1¾
Oats	,,	0	5	4¾	0	5	9½	0	6	0
Barley	,,	0	6	10½	0	7	1	0	7	2½
Hay	,,	0	3	0½	0	2	11	0	3	1¼
Potatoes	,,	0	3	4¼	0	3	1	0	2	10¼
Butter	,,	4	15	9½	4	19	2	4	16	4¼
Flax	per 14 lb.	0	7	1	0	6	8¼	0	6	5
Wool	per lb.	0	0	6¼	0	0	5⅝	0	0	5¼
Eggs	per 120	0	6	7¾	0	6	8	0	6	7¼
Beef	per cwt.	2	17	0¼	2	15	3¼	2	18	7¼
Mutton	,,	3	2	10¾	3	0	8½	2	19	7¾
Pork	,,	2	4	9¾	2	8	11¼	2	9	2¼
Cattle, one year old ...	per head	6	17	3	6	17	2	6	12	3
Two ,, ...	,,	9	12	10	9	13	2	9	9	8
Three ,, ...	,,	12	3	4	12	6	3	12	9	4
Springers	,,	13	5	8	13	10	1	13	6	4
Lambs	,,	1	4	3	1	2	7	1	3	5
Sheep over 12 and under 24 months old ...	,,	1	14	8	1	13	11	1	12	3
,, Two years old and over	,,	1	16	6	1	15	0	1	16	9

LIVE WEIGHT PRICES OF CATTLE.

The returns received by the Board of Agriculture from the twenty-one places scheduled under the Markets and Fairs (Weighing of Cattle) Act, 1891, showed that during the first quarter of 1903 a larger number of cattle and swine were exposed for sale at these towns than during the corresponding period of any recent year. The number of sheep, however, showed a slight diminution compared with the first quarter of 1902.

Animals.	1st Quarter, 1903.	1st Quarter, 1902.
	No.	No.
CATTLE:		
Entering markets	296,220	278,534
Weighed	42,852	43,379
Prices returned	35,193	35,217
Prices returned with quality distinguished ...	29,641	29,764
SHEEP:		
Entering markets	754,537	759,637
Weighed	9,105	9,023
Prices returned with quality distinguished ...	8,515	8,099
SWINE:		
Entering markets	123,228	10[illegible],271
Weighed	586	371
Prices returned with quality distinguished ...	586	337

There was some falling off in the proportion of cattle weighed as compared with the March quarter of 1902. This may, perhaps, be attributed to the largely increased numbers which entered some of the English markets where the weighing of cattle is but little practised, as, for instance, at York, where no cattle were weighed, although 24,345 entered the market, as against 15,826 in the first three months of last year, and at Norwich, where the number exposed was greater by 10,000, but

only 52 were weighed out of a total of 30,628. Of the total number entering the fifteen English markets about 9 per cent. were weighed, while in the six Scottish markets the proportion weighed amounted to about 36 per cent.

A large number of the sheep sold at Aberdeen were weighed, but this is almost the only scheduled market where the practice obtains to any extent.

The following table shows, for cattle of each grade, the average local price for the quarter at thirteen of the scheduled markets, so far as it can be ascertained from the data furnished, though it will be seen that in several instances the number of animals classed as of second and third quality is too small to afford a satisfactory basis for the calculation of an average for these grades :—

PLACES.	INFERIOR or Third Quality.			GOOD or Second Quality.			PRIME or First Quality.		
	Number.	Price per Stone.	Price per Cwt.	Number.	Price per Stone.	Price per Cwt.	Number.	Price per Stone.	Price per Cwt.
		s. d.	s. d.		s. d.	s. d.		s. d.	s. d.
Carlisle ...	413	3 5¼	27 6	404	3 10¼	31 0	2,690	4 5½	35 8
Leicester ...	—	—	—	36	3 9¼	30 2	357	4 5¾	35 10
Leeds ...	—	—	—	196	4 0¼	32 2	472	4 6¾	36 6
Liverpool ...	299	3 5½	27 8	238	4 1¼	32 10	1,529	4 5	35 4
London ...	—	—	—	294	4 4½	35 0	844	4 10¼	38 10
Newcastle ...	—	—	—	50	4 2¾	33 10	860	4 10	38 8
Shrewsbury	176	3 9½	30 4	300	4 2½	33 8	237	4 6¼	36 2
Aberdeen ...	1,695	3 4½	27 0	1,798	4 5	35 4	2,531	4 8¼	37 8
Dundee ...	546	3 2¾	25 10	1,002	4 5¾	35 10	624	4 10½	39 0
Edinburgh...	8	4 3	34 0	2,623	4 7¼	36 10	295	4 11¼	39 8
Falkirk ...	146	4 0½	32 4	480	4 5¾	35 10	321	4 9½	38 4
Glasgow ...	173	4 4	34 8	516	4 6½	36 4	1,764	4 8½	37 8
Perth ...	76	4 1¼	33 2	548	4 5¼	35 6	814	4 9¾	38 6

That the prices obtained were in most cases higher than at the same time last year is shown in a convenient form in the following table, in which the returns from the thirteen

markets above specified are combined month by month through the quarter now reported on, and also in the later month of April. These quotations give a general indication of the prevailing live weight prices in the country as a whole. The average price arrived at in the same manner for December last was 38s. per cwt. for first, and 36s. for second quality beasts. By February prices of both qualities appear to have fallen by a shilling per cwt., while in April they stood at 37s. 2d. and 35s. 2d. per cwt. respectively:—

Month.	Prime or First Quality.		Good or Second Quality.	
	1903.	1902.	1903	1902.
	Per cwt. *s.* *d.*	Per cwt. *s.* *d.*	Per cwt. *s.* *d.*	Per cwt. *s.* *d.*
January	37 8	36 2	36 2	34 6
February	37 0	36 4	35 0	34 6
March	37 0	36 4	35 4	34 6
April	37 2	37 8	35 2	35 10

Although the calculated live weight price of some 29,000 beasts was available for compiling the above table, only eight of the scheduled markets reported actual sales of fat cattle by live weight, *i.e.*, at an agreed price per stone or per cwt., the number so sold being 2,709, Glasgow furnishing about one-half of these transactions.

The number of store cattle weighed for which prices were given in the first three months of 1903 was 4,083; of these, 3,843 were returned from Shrewsbury, where the practice of weighing store cattle prevails to a considerable extent. The other markets from which returns relating to store cattle were received were Leicester, Aberdeen, Dundee, and Edinburgh, but the numbers in each case were inconsiderable.

The usual table showing the numbers of cattle, sheep, and swine entering the markets, with the numbers weighed and priced, is given on the next page.

CATTLE, SHEEP, AND SWINE *entering and weighed at the Markets and Marts of the undermentioned Places in the* FIRST QUARTER *of* **1903**, *as returned under the Markets and Fairs (Weighing of Cattle) Act,* 1891 (54 *and* 55 *Vict. c.* 70).

PLACES.	Cattle.			Sheep.			Swine.		
	Total Number entering the Markets or Marts.	Number Weighed.	Number Weigh'd for which Prices were given.	Total Number entering the Markets or Marts.	Number Weighed.	Number Wgh'd for which Prices were given.	Total Number entering the Markets or Marts.	Number Weighed.	Number Wgh'd for which Prices were given.
ENGLAND.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
Ashford ...	1,916	23	—	10,772	—	—	5,786	—	—
Birmingham ...	5,281	—	—	6,823	—	—	65,059	—	—
Bristol... ...	12,305	—	—	14,330	—	—	—	—	—
Carlisle ...	14,374	3,507	3,507	42,802	—	—	3,639	—	—
Leicester ...	11,900	551	426	10,881	—	—	2,316	—	—
Leeds	8,914	668	668	24,480	61	61	113	—	—
Lincoln ...	2,524	1	1	18,035	—	—	2,997	9	9
Liverpool ...	15,790	2,066	2,066	59,732	848	848	156	—	—
London ...	19,520	4,096	1,138	120,240	559	—	450	—	—
Newcastle-upon-Tyne ...	24,023	910	910	66,152	—	—	10,443	421	421
Norwich ...	30,628	52	41	38,049	—	—	8,219	—	—
Salford ...	29,555	1,127	—	92,545	—	—	750	—	—
Shrewsbury ...	14,566	5,871	4,556	8,118	—	—	8,200	—	—
Wakefield ...	18,618	1,497	161	40,682	23	—	2,760	78	78
York	24,345	—	—	17,269	—	—	2,131	—	—
SCOTLAND.									
Aberdeen ...	11,085	6,162	6,162	17,120	6,697	6,697	2,874	—	—
Dundee ...	4,087	2,182	2,182	4,939	558	558	710	—	—
Edinburgh ...	16,418	6,647	*2,985	65,961	—	—	2,674	—	—
Falkirk ...	2,424	947	947	1,782	—	—	28	—	—
Glasgow ...	17,325	3,217	2,453	58,259	38	30	1,305	—	—
Perth... ...	10,622	3,328	*1,438	35,566	321	321	2,618	78	78
TOTAL for ENGLAND ...	234,259	20,369	13,474	570,910	1,491	909	113,019	508	508
TOTAL for SCOTLAND ...	61,961	22,483	*16,167	183,627	7,614	7,606	10,209	78	78
Total ...	296,220	42,852	*29,641	754,537	9,105	8,515	123,228	586	586

* Prices for 3,662 cattle in addition to the above were quoted from Edinburgh and for 1,890 cattle from Perth, but without distinguishing the quality.

PRICES OF MEAT, CORN, AND DAIRY PRODUCE.

Average Prices of Dead Meat, per 8 lb., at the London Central Meat Market, during the First Quarter of 1903, and during the Months of March, April, and May, 1903.

(Compiled from the prices quoted weekly in the "Meat Trades' Journal.")

Description.	1st Quarter. 1903.	March. 1903.	April. 1903.	May. 1903.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Beef :—				
Scotch, short sides	4 4 to 4 7	4 2 to 4 6	4 3 to 4 5	4 1 to 4 5
,, long sides	4 0 ,, 4 3	3 11 ,, 4 2	3 11 ,, 4 1	3 11 ,, 4 1
English...	3 9 ,, 4 0	3 9 ,, 4 0	3 10 ,, 4 0	3 8 ,, 3 11
Cows and Bulls	2 3 ,, 3 5	2 2 ,, 3 5	2 1 ,, 3 4	2 2 ,, 3 3
American, Deptford killed ...	3 9 ,, 4 0	3 8 ,, 3 11	3 8 ,, 3 10	3 6 ,, 3 8
,, Birkenhead killed...	3 8 ,, 3 10	3 7 ,, 3 10	3 7 ,, 3 9	3 6 ,, 3 7
Argentine, Deptford killed ...	3 4 ,, 3 8	3 4 ,, 3 8	3 0 ,, 3 5	2 9 ,, 3 3
American, Refrig. hind-quarters	3 7 ,, 3 11	3 7 ,, 3 10	3 7 ,, 3 10	3 7 ,, 3 9
,, ,, fore-quarters	2 7 ,, 2 9	2 7 ,, 2 9	2 8 ,, 2 10	2 6 ,, 2 8
Australian, Frozen, hind-quarters	2 5 ,, —	2 4 ,, —	2 7 ,, 2 8	—
,, ,, fore-quarters	2 0 ,, —	2 0 ,, —	2 3 ,, 2 4	—
River Plate, ,, hind-quarters	2 8 ,, —	2 7 ,, —	2 10 ,, —	2 11 ,, —
,, ,, fore-quarters	2 2 ,, —	2 3 ,, —	2 6 ,, —	2 4 ,, —
New Zealand, ,, hind-quarters	2 9 ,, 2 10	2 8 ,, 2 9	2 11 ,, —	3 0 ,, —
,, ,, fore-quarters	2 2 ,, —	2 3 ,, —	2 6 ,, —	2 4 ,, —
Mutton :—				
Scotch	5 0 ,, 5 6	5 0 ,, 5 6	4 10 ,, 5 4	4 7 ,, 5 5
English	4 9 ,, 5 3	4 10 ,, 5 4	4 6 ,, 5 0	4 2 ,, 4 11
Ewes	3 9 ,, 4 4	3 10 ,, 4 5	3 9 ,, 4 2	3 6 ,, 3 11
Continental	4 7 ,, 4 11	—	—	—
New Zealand, Frozen... ...	2 8 ,, 3 5	2 3 ,, 3 4	2 3 ,, 3 3	2 2 ,, 2 11
Australian, Frozen	2 4 ,, —	2 4 ,, —	2 5 ,, —	2 4 ,, 2 5
River Plate, Frozen	2 7 ,, 2 8	2 4 ,, 2 5	2 6 ,, —	2 5 ,, —
Lamb :—				
English	—	—	5 11 ,, 7 4	5 6 ,, 7 0
New Zealand, Frozen... ...	4 1 ,, 4 3	3 10 ,, 4 2	3 4 ,, 3 8	3 0 ,, 3 3
Veal :—				
Best	4 10 ,, 5 4	4 11 ,, 5 6	4 11 ,, 5 7	4 5 ,, 4 9
Secondary and middling ...	3 11 ,, 4 8	3 10 ,, 4 9	3 10 ,, 4 9	3 8 ,, 4 3
Pork :—				
English, best	3 11 ,, 4 3	4 0 ,, 4 4	4 2 ,, 4 6	3 10 ,, 4 2
,, seconds and thirds ...	3 5 ,, 3 9	3 5 ,, 3 9	3 5 ,, 3 9	3 2 ,, 3 6

AVERAGE WHOLESALE PRICES of CATTLE and SHEEP, per 8 lb., sinking the offal, at the METROPOLITAN CATTLE MARKET, during the under-mentioned Quarters of 1902 and 1903.

PERIOD.	CATTLE.			SHEEP.		
	Inferior.	Second.	First.	Inferior.	Second.	First.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1st Quarter, 1902	2 7	3 11	4 8	3 6	4 10	5 6
2nd Quarter, ,,	3 3	4 6	5 1	3 10	5 2	6 0
3rd Quarter, ,,	3 1	4 7	5 1	3 8	5 0	5 9
4th Quarter, ,,	2 9	4 4	5 1	3 7	5 0	5 11
1st Quarter, 1903	3 2	4 5	4 11	3 8	5 5	6 2

AVERAGE WHOLESALE PRICES of BEEF and MUTTON, per 8 lb., by the Carcase, at LIVERPOOL and GLASGOW, during the under-mentioned Quarters of 1902 and 1903.

PERIOD.	LIVERPOOL.*		GLASGOW.†	
	BEEF.	MUTTON.	BEEF.	MUTTON.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
1st Quarter, 1902	2 6 to 4 0	3 4 to 5 4	4 4 to 4 10	5 0 to 5 10
2nd Quarter, ,,	3 4 ,, 4 8	3 6 ,, 5 6	4 4 ,, 5 8	4 4 ,, 6 8
3rd Quarter, ,,	2 8 ,, 4 8	3 4 ,, 5 0	4 2 ,, 5 6	4 0 ,, 5 8
4th Quarter, ,,	2 8 ,, 4 4	3 4 ,, 5 2	3 8 ,, 5 0	4 4 ,, 5 8
1st Quarter, 1903	2 8 ,, 4 2	4 0 ,, 6 0	3 8 ,, 4 10	5 0 ,, 6 4

* Compiled from information furnished by the Medical Officer of Health, Liverpool. The prices quoted are for Carcases of Animals *slaughtered at the Liverpool Abattoir*, and do not apply to Imported Meat.

† Compiled from information furnished by the Principa of the Veterinary College, Glasgow.

BERLIN MARKET.

AVERAGE PRICES of CATTLE, SHEEP, and SWINE (Dead Weight) in the BERLIN CATTLE MARKET in the under-mentioned Months of 1903.

MONTHS.	OXEN.		SHEEP.		SWINE.	
	Per Cwt.		Per Cwt.		Per Cwt.	
1903.	s.	d.	s.	d.	s.	d.
February	62	4	64	11	54	0
March	61	7	63	8	50	3
April	61	10	63	8	50	3

NOTE.—The above prices are compiled from the Wholesale Prices quoted in the *Monatliche Nachweise über den auswärtigen Handel des deutschen Zollgebiets.* The prices for swine are live weight prices with 20 per cent. tare.

PARIS MARKET.

AVERAGE PRICES of CATTLE, SHEEP, and SWINE (Medium Quality, Dead Weight), per cwt., in the PARIS CATTLE MARKET in the under-mentioned Months of 1903.

MONTHS.	OXEN.		CALVES.		SHEEP.		PIGS.	
	Per Cwt.		Per Cwt.		Per Cwt.		Per Cwt.	
1903.	s.	d.	s.	d.	s.	d.	s.	d.
March	52	6	75	9	81	5	56	2
April	52	11	74	4	81	2	54	1
May	52	5	66	2	79	5	56	6

NOTE.—The above prices have been compiled from the weekly returns published in the *Journal d'Agriculture Pratique.*

CHICAGO.

AVERAGE PRICES of CATTLE at CHICAGO per cwt. (Live Weight) in the under-mentioned Months of 1903.

MONTH.	*Medium to Good Steers.*					*Good to Choice Steers.*					*Choice to Extra Prime Steers.*				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*
March	21	3	to	23	1	23	1	to	25	0	25	0	to	27	8
April	22	3	,,	23	11	23	11	,,	25	11	25	11	,,	27	4
May	21	11	,,	23	4	23	5	,,	25	2	25	4	,,	26	8

Compiled from the Live Stock Reports issued by Messrs. Clay, Robinson and Co., of the Union Stock Yards, Chicago, Illinois.

AVERAGE VALUES, per cwt., of various Kinds of DEAD MEAT Imported into the United Kingdom from FOREIGN COUNTRIES and BRITISH POSSESSIONS in the under-mentioned Quarters of 1902 and 1903.

(Computed from the Trade and Navigation Accounts.)

PERIOD.	BEEF. Fresh.		BEEF. Salted.		MUTTON. Fresh.		PORK. Fresh.		PORK. Salted.		BACON.		HAMS.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
1st Quarter, 1902 ...	40	3	28	8	35	1	43	3	31	6	47	8	48	3
2nd Quarter, ,, ...	43	6	31	4	38	1	44	11	28	10	51	3	50	0
3rd Quarter, ,, ...	43	10	33	2	38	5	44	2	28	4	55	8	54	9
4th Quarter, ,, ...	42	11	34	6	39	7	44	9	31	0	56	10	55	8
1st Quarter, 1903 ...	41	9	34	3	39	8	44	8	31	0	52	9	54	0

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels,* computed from the Weekly Averages of Corn Returns from the Returning Markets of ENGLAND AND WALES, pursuant to the Corn Returns Act, 1882, together with the QUANTITIES returned as sold at such Markets, in the under-noted periods of the Years 1903, 1902, and 1901.

QUARTER ENDED	PRICES.			QUANTITIES.		
	1903.	1902.	1901.	1903.	1902.	1901.
Wheat.						
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	25 2	27 3	26 3	694,912	826,066	744,018
Midsummer ...	—	29 10	27 1	—	444,639	547,737
Michaelmas ...	—	30 2	26 11	—	222,495	535,109
Christmas ...	—	25 0	26 7	—	754,737	778,686
Barley.						
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	23 5	26 8	25 3	975,720	669,251	844,616
Midsummer ...	—	25 6	24 9	—	40,875	53,408
Michaelmas ...	—	25 1	24 0	—	32,318	236,164
Christmas ...	—	25 5	26 8	—	2,040,980	2,235,441
Oats.						
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	16 11	20 3	17 6	372,119	239,048	236,316
Midsummer ...	—	22 1	19 3	—	88,274	81,172
Michaelmas ...	—	21 3	18 7	—	101,130	131,023
Christmas ...	—	17 0	18 4	—	402,833	265,703

* Section 8 of the Corn Returns Act, 1882, provides that where returns of purchases of British Corn are made to the local inspector of Corn Returns in any other measure than the imperial bushel or by weight or by a weighed measure, that officer shall convert such returns into the imperial bushel, and in the case of weight or weighed measure the conversion is to be made at the rate of 60 imperial pounds for every bushel of wheat, 50 imperial pounds for every bushel of barley, and 39 imperial pounds for every bushel of oats.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each of the under-mentioned Weeks in 1903, and in the corresponding Weeks in 1902 and 1901.

Weeks ended (in 1903).	Wheat.						Barley.						Oats.					
	1903.		1902.		1901.		1903.		1902.		1901.		1903.		1902.		1901.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Jan. 3 ...	25	0	27	7	26	5	23	11	26	7	25	4	16	10	19	10	17	2
,, 10 ...	24	11	27	8	26	7	24	1	26	7	25	6	17	0	20	0	17	3
,, 17 ...	24	11	27	8	26	11	24	1	26	11	25	9	16	10	20	0	17	3
,, 24 ...	25	0	27	7	26	10	24	1	26	7	25	6	16	11	20	3	17	6
,, 31 ...	25	4	27	4	26	7	24	3	26	7	25	7	17	0	20	2	17	8
Feb. 7 ...	25	6	27	2	26	8	23	9	26	9	25	7	16	11	20	3	17	7
,, 14 ...	25	6	26	11	26	4	23	7	27	5	25	4	17	1	20	3	17	7
,, 21 ...	25	4	27	1	26	1	23	4	26	11	25	0	17	1	20	4	17	7
,, 28 ...	25	3	27	1	25	11	23	2	26	8	25	0	17	1	20	5	17	9
Mar. 7 ...	25	3	27	0	25	9	23	1	26	8	25	4	17	1	20	5	17	7
,, 14 ...	25	1	27	1	25	9	22	10	26	6	25	1	17	0	20	6	17	7
,, 21 ...	25	1	27	1	25	8	22	9	26	4	24	11	16	10	20	6	17	9
,, 28 ...	25	2	27	2	26	0	22	4	27	2	24	9	17	0	20	7	18	0
Apl. 4 ...	25	3	27	3	26	3	22	6	26	5	25	3	17	0	20	6	18	0
,, 11 ...	25	4	27	5	26	5	21	10	26	7	26	0	17	2	21	0	18	1
,, 18 ...	25	6	27	7	26	8	21	6	27	1	25	7	17	3	21	1	18	8
,, 25 ...	26	1	28	9	26	8	21	9	26	5	25	8	17	9	21	6	18	8
May 2 ...	26	10	29	9	26	9	22	1	27	5	26	4	18	0	21	10	19	1
,, 9 ...	27	6	30	9	27	3	21	10	26	10	26	2	18	2	22	6	19	1
,, 16 ...	27	9	31	1	27	7	22	5	25	3	24	2	18	4	22	5	19	4
,, 23 ...	27	10	31	6	27	7	23	7	25	4	24	1	18	5	22	6	19	8
,, 30 ...	27	8	31	6	27	7	23	7	25	1	23	8	18	5	22	10	19	9
June 6 ...	27	6	31	3	27	6	23	10	24	3	22	9	18	4	22	11	20	1
,, 13 ...	27	8	30	11	27	8	21	5	23	8	24	0	18	7	22	8	19	7
,, 20 ...	27	6	30	6	27	6	20	7	23	5	23	2	18	3	23	0	20	3
,, 27 ...			30	5	27	6			24	3	25	4			22	9	20	0
July 4 ...			30	8	27	8			25	5	21	9			22	5	19	10
,, 11 ...			30	10	27	2			24	8	23	10			22	10	19	9
,, 18 ...			30	11	27	3			23	8	23	4			22	10	19	11
,, 25 ...			31	5	27	3			25	0	22	1			22	8	19	4
Aug. 1 ...			31	8	27	6			25	0	23	1			22	10	20	0
,, 8 ...			31	7	27	7			24	11	22	1			22	11	19	4
,, 15 ...			31	7	27	4			24	9	27	2			22	2	18	9
,, 22 ...			31	5	27	3			22	10	23	7			21	11	18	1
,, 29 ...			31	7	27	0			26	2	24	3			21	0	17	10
Sept. 5 ...			29	9	26	5			24	6	25	1			19	10	17	6
,, 12 ...			27	10	26	2			27	5	24	11			19	2	17	4
,, 19 ...			27	1	26	0			26	4	25	5			18	4	17	4
,, 26 ...			26	6	25	10			26	4	25	10			18	0	17	2
Oct. 3 ...			25	10	25	8			25	11	26	3			17	5	17	7
,, 10 ...			25	5	25	9			26	2	26	5			17	2	17	6
,, 17 ...			25	1	25	10			26	1	26	8			17	0	17	8
,, 24 ...			24	11	25	11			26	4	26	10			17	0	17	5
,, 31 ...			25	0	26	2			26	7	26	10			17	3	17	7
Nov. 7 ...			25	1	26	6			26	3	27	0			17	2	17	8
,, 14 ...			25	0	26	9			25	11	26	9			17	3	18	3
,, 21 ...			24	11	27	1			25	6	26	10			17	2	18	7
,, 28 ...			25	0	27	1			24	11	26	9			17	0	18	9
Dec. 5 ...			25	1	27	1			24	4	26	7			17	0	19	0
,, 12 ...			25	0	27	2			24	3	26	8			16	10	19	3
,, 19 ...			24	10	27	7			24	2	26	8			16	10	19	8
,, 26 ...			24	10	27	7			24	1	26	8			16	8	19	10

AVERAGE PRICES of WHEAT, BARLEY, and OATS, per IMPERIAL QUARTER in BELGIUM in the under-mentioned Months of 1903.

Month.	Wheat.		Barley.		Oats.	
1903.	s.	d.	s.	d.	s.	d.
February	27	4	22	5	17	9
March	27	4	22	5	17	6
April	27	10	22	7	17	3

The above prices have been compiled from the official monthly averages published in the *Moniteur Belge.*

AVERAGE PRICES of WHEAT, BARLEY, and OATS, per IMPERIAL QUARTER in FRANCE, and ENGLAND and WALES, in the under-mentioned Months of 1903.

MONTH.	FRANCE.		ENGLAND.	
WHEAT.				
1903.	Per Qr. s.	d.	Per Qr. s.	d.
March	38	7	25	1
April	39	11	25	6
May	41	6	27	6
BARLEY.				
1903.	Per Qr. s.	d.	Per Qr. s.	d.
March	23	8	22	9
April	23	9	21	10
May	24	2	22	8
OATS.				
1903.	Per Qr. s.	d.	Per Qr. s.	d.
March	19	5	16	11
April	19	6	17	3
May	19	6	18	3

NOTE.—The prices of French grain have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique.* The prices of British grain are official averages based on the weekly returns furnished under the Corn Returns Act, 1882.

AVERAGE PRICES of WHEAT, BARLEY, and OATS per IMPERIAL QUARTER at LONDON, PARIS, and BERLIN, in the under-mentioned Months of 1903.

Month.	London.		Paris.		Berlin.	
WHEAT.						
	Per Qr.		Per Qr.		Per Qr.	
	s.	d.	s.	d.	s.	d.
February, 1903	26	2	39	7	34	1
March ,, ...	25	9	39	1	33	11
April ,, ...	26	1	41	4	34	6
May ,, ...	28	1	42	8	—	
BARLEY.						
	Per Qr.		Per Qr.		Per Qr.	
	s.	d.	s.	d.	s.	d.
February, 1903	21	11	23	10	24	2*
March ,, ...	21	9	24	0	23	6*
April ,, ...	23	9	24	2	23	4*
May ,, ...	20	6	24	9	—	
OATS.						
	Per Qr.		Per Qr.		Per Qr.	
	s.	d.	s.	d.	s.	d.
February, 1903	17	7	19	2	20	4
March ,, ...	17	11	19	1	20	0
April ,, ...	18	4	18	10	19	7
May ,, ...	18	11	18	9	—	

NOTE.—The London quotations represent the price of British corn as returned under the Corn Returns Act, 1882; the prices of grain in Paris have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the quotations for Berlin are the average prices published monthly in the *Monatliche Nachweise über den auswärtigen Handel des deutschen Zollgebiets*.

* Prices at Breslau; no quotations for Berlin.

PRICES OF WOOL.

AVERAGE PRICES of ENGLISH WOOL, per pack of 240 lb., in the under-mentioned Months of 1903.

(*Compiled from the "Economist."*)

DESCRIPTION.	March.	April.	May.
	£ s. £ s.	£ s. £ s.	£ s. £ s.
South Down ...	8 10 to 11 10	8 10 to 11 10	8 10 to 11 10
Half-breds ...	6 15 ,, 8 0	6 0 ,, 7 5	6 0 ,, 7 5
Leicester ...	6 5 ,, 7 0	6 0 ,, 6 5	6 0 ,, 6 5
Kent Fleeces ...	6 10 ,, 7 0	6 10 ,, 7 0	6 10 ,, 7 0

AVERAGE WHOLESALE PRICES of BUTTER, MARGARINE, and CHEESE in the under-mentioned Months of 1903.

(Compiled from the "Grocer.")

DESCRIPTION.	MARCH.	APRIL.	MAY.
	Per Cwt.*	Per Cwt.*	Per Cwt.*
BUTTER:	s. d. s. d.	s. d. s. d.	s. d. s. d.
Cork, 1sts	106 6 to —	96 3 to —	89 3 to —
,, 2nds	98 6 ,, —	91 0 ,, —	85 0 ,, —
,, 3rds	90 3 ,, —	84 0 ,, —	79 7 ,, —
,, 4ths	82 9 ,, —	77 3 ,, —	75 3 ,, —
Irish Creameries ...	—	102 0 ,, 106 0	96 0 ,, 99 6
,, Factories ...	—	86 0 ,, 96 0	84 6 ,, 93 3
Dutch, Friesland ...	108 0 ,, 110 0	—	—
,, Creameries ...	110 6 ,, 114 0	100 0 ,, 104 6	91 6 ,, 96 6
,, Rolls, boxes ...	12 9 ,, 13 3	12 0 ,, 12 9	11 1 ,, 11 8
French, extra mild ...	113 0 ,, 116 9	101 6 ,, 105 0	96 0 ,, 98 6
,, best ordinary ...	106 0 ,, 111 0	94 6 ,, 100 0	92 0 ,, 94 6
,, 2nds and inferior ...	83 0 ,, 102 6	79 6 ,, 91 0	82 9 ,, 88 6
,, Fresh, Paris baskets	113 6 ,, 117 9	101 6 ,, 105 0	96 6 ,, 100 6
,, Rolls, per doz. ...	10 0 ,, 14 10	9 6 ,, 13 6	9 5 ,, 12 10
Italian Rolls, per doz.	11 4 ,, 13 3	10 6 ,, 12 0	10 0 ,, 11 10
Danish and Swedish ...	116 3 ,, 119 3	107 6 ,, 110 0	98 6 ,, 101 6
Russian and Siberian ...	84 6 ,, 100 6	79 6 ,, 96 6	80 6 ,, 90 6
Argentine	102 0 ,, 104 6	90 0 ,, 98 6	80 9 ,, 93 3
Colonial, fine	102 0 ,, 107 0	97 0 ,, 103 0	94 9 ,, 99 6
,, good and inferior	83 0 ,, 98 6	79 6 ,, 92 6	77 6 ,, 90 0
Canadian Creameries ...	80 0 ,, 94 0	80 6 ,, 92 6	81 0 ,, 92 6
,, Dairies	—	—	72 0 ,, 77 0
MARGARINE	38 0 ,, 57 6	38 0 ,, 55 6	36 10 ,, 53 2
CHEESE, ENGLISH: Cheddar, ...	63 9 ,, 76 0	64 0 ,, 77 6	66 6 ,, 78 0
,, loaf	71 6 ,, 74 0	73 6 ,, 75 6	74 0 ,, 76 0
Wiltshire ,, ...	74 0 ,, 76 0	74 0 ,, 76 0	—

* Except where otherwise stated.

WEEKLY PRICES (WHOLESALE) of VEGETABLES and FRUIT at COVENT GARDEN in each week of May, 1903.

(Compiled from the "Gardeners' Chronicle.")

Description.	Week ending May 7th.	May 14th.	May 21st.	May 28th.
VEGETABLES—	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Artichokes, Globe, per dozen	1 0 to 2 0	1 6 to 2 0	2 0 to 2 6	1 6 to 4 0
Asparagus, Eng., bndl.	1 6 ,, 4 0	1 6 ,, 3 0	1 6 ,, 3 0	1 9 ,, 3 0
Beans, dwarf, per lb.	0 9 ,, 1 0	0 9 ,, 0 10	0 9 —	1 0 ,, 1 3
,, Channel I. per lb.	0 9 ,, 0 10	0 9 ,, 0 10	0 9 —	1 0 ,, 1 3
Beetroots, per bushel	1 0 —	1 6 ,, 1 9	1 6 ,, 1 9	1 9 ,, 2 0
Cabbages, per tally	2 0 ,, 3 0	1 0 ,, 2 6	1 0 ,, 2 6	1 0 ,, 1 6
Carrots, doz. bunches	1 6 ,, 2 0	1 6 ,, 2 0	1 6 ,, 2 0	1 6 ,, 2 0
,, washed, bags	2 6 ,, 3 0	2 6 ,, 3 0	2 6 ,, 3 6	3 0 ,, 4 0
Cauliflowers, per doz.	1 6 ,, 1 9	1 6 ,, 1 9	1 6 ,, 2 6	1 0 ,, 2 0
Celery, per doz. bndls.	6 0 —	6 0 —	6 0 —	6 0 —
Cress, per doz. punnets	1 3 —	1 3 —	1 3 —	1 3 —
Cucumbers, per doz.	2 0 ,, 3 6	1 6 ,, 2 6	1 6 ,, 2 3	2 0 ,, 3 6
Leeks, per doz. bnchs.	0 9 ,, 1 0	0 6 ,, 0 9	0 6 ,, 0 9	0 6 ,, 0 9
Lettuces cabbage, doz.	0 8 ,, 1 3	0 4 ,, 0 8	0 6 ,, 1 0	0 6 ,, 1 0
,, cos. per doz.	3 0 ,, 4 0	3 0 ,, 4 0	4 0 ,, 5 0	3 0 ,, 4 0
Mint, per doz. bunches	2 0 ,, 3 0	2 0 ,, 2 6	2 0 —	2 0 —
Mushrooms, House, lb.	1 0 —	0 10 ,, 1 0	0 6 ,, 0 9	0 8 ,, 0 10
Onions, picklers, sieve	3 0 ,, 3 6	3 0 ,, 3 6	3 0 ,, 3 6	3 0 ,, 3 6
Parsley, doz. bunches	1 0 ,, 1 6	1 0 ,, 1 6	1 0 ,, 1 6	1 0 ,, 1 6
,, per sieve	0 9 ,, 1 0	0 6 ,, 1 0	0 6 ,, 1 0	0 6 ,, 1 0
Peas, frame, per lb.	0 9 ,, 0 10	0 9 ,, 1 0	0 8 ,, 1 0	1 3 ,, 1 6
,, per flat	4 0 ,, 5 0	4 0 ,, 4 6	4 0 ,, 5 0	4 0 ,, 5 0
Potatoes, per ton	120 0 ,, 150 0	110 0 ,, 150 0	110 0 ,, 150 0	110 0 ,, 140 0
,, Teneriffe, new, per cwt	12 0 ,, 16 0	12 0 ,, 15 0	10 0 ,, 15 0	10 0 ,, 12 0
Radishes, doz. bunches	0 4 ,, 1 0	0 3 ,, 0 9	0 3 ,, 1 0	0 3 ,, 1 0
Rhubarb, outdoor	2 0 ,, 3 0	3 0 ,, 3 6	3 0 ,, 3 6	3 6 ,, 4 6
Salad, small punnets, per doz.	1 3 —	1 3 —	1 3 —	1 3 —
Spinach, per bushel	1 0 ,, 2 0	0 6 ,, 1 0	0 6 ,, 1 0	0 6 ,, 1 0
Tomatoes, English, new, per 12lb.	8 0 ,, 10 0	6 0 ,, 8 0	6 0 ,, 7 6	6 0 ,, 7 0
,, Channel Islands per lb.	0 9 —	0 6 —	0 6 ,, 0 6½	0 5½ ,, 0 6
Turnips, new, bunch	0 4 ,, 0 8	0 4 ,, 0 6	0 4 ,, 0 6	0 4 ,, 0 6
Vegetable marrow, doz	4 0 ,, 8 0	6 0 —	9 0 ,, 12 0	6 0 ,, 9 0
Watercress, doz. bnchs.	0 4 ,, 0 6	0 4 ,, 0 6	0 4 ,, 0 6	0 4 ,, 0 6
FRUIT—				
Apples, Australian, including Tasmanian, per case	8 0 ,, 13 0	8 0 ,, 14 0	8 0 ,, 14 0	8 0 ,, 12 0
Cherries, per box	1 3 ,, 2 0	1 0 ,, 1 2	1 0 —	1 0 ,, 1 6
Grapes, Muscat, A, lb.	8 0 ,, 10 0	6 0 ,, 8 0	5 0 ,, 7 0	3 0 ,, 4 0
,, ,, B, lb.	4 0 ,, 6 0	4 0 ,, 5 0	2 0 ,, 3 0	1 6 ,, 2 0
,, Hambrg. A, lb.	3 0 ,, 4 0	3 0 ,, 4 0	3 0 ,, 4 0	3 0 ,, 4 0
,, ,, B, lb.	2 0 ,, 2 6	1 6 ,, 2 0	1 6 ,, 2 0	1 6 ,, 2 0
,, Almeria, doz lb.	6 0 ,, 10 0	6 0 ,, 10 0	6 0 ,, 10 0	— —
Gooseberries, per peck	7 0 —	4 0 ,, 4 6	*4 6 ,, 8 0	*8 0 ,, 9 0
Strawberries, A, per lb.	3 0 ,, 4 0	3 0 ,, 4 0	3 0 ,, 4 0	3 0 ,, 4 0
,, B, per lb.	1 0 ,, 2 0	1 0 ,, 2 0	1 0 ,, 1 6	1 3 ,, 1 9

* Per sieve.

DISEASES OF ANIMALS ACTS, 1894 and 1896.

NUMBER of OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture.)

DISEASE.	QUARTER ENDED.	
	March, 1903.	March, 1902.
Foot-and-Mouth Disease :—		
Outbreaks	—	1
Animals attacked	—	30
Swine-Fever :—		
Outbreaks	353	399
Swine Slaughtered as diseased or exposed to infection	1,634	2,122
Rabies :—		
Number of Cases :		
Dogs	—	8
Other Animals	—	—
Anthrax :—		
Outbreaks	204	202
Animals attacked	323	357
Glanders (including Farcy) :—		
Outbreaks	303	285
Animals attacked	538	543
Sheep-Scab :—		
Outbreaks	953	911
Animals attacked	10,064	10,648

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction in Ireland.)

DISEASE.	QUARTER ENDED.	
	March, 1903.	March, 1902.
Swine-Fever :—		
Outbreaks	14	36
Swine Slaughtered as diseased or exposed to infection	407	644
Glanders (including Farcy) :—		
Outbreaks	1	4
Animals attacked	2	13
Sheep-Scab :—		
Outbreaks	331	363

ORDNANCE SURVEY MAPS OF GREAT BRITAIN AND IRELAND.

The chief Maps published by the Ordnance Survey are on the following scales :—

Scale		Price per Sheet, Uncoloured.
$\frac{1}{500}$ or about 10 feet to one mile ...	For towns only	**2s. 6d.**
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$\frac{1}{2500}$ or 25·344 inches to a mile complete for Great Britain. (*In progress in Ireland*)		**3s. 0d.** With areas. **2s. 6d.** Without Areas.
$\frac{1}{10560}$ or six inches to a mile complete for Great Britain and Ireland		**2s. 6d.** Per full sheet. **1s. 0d.** Per Quarter Sheet.
$\frac{1}{63360}$ or one inch to the mile :—		
1. Outline with contours		**1s. 0d.** *Per Sheet for England, Wales and Ireland.*
2. With Hills in black		
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4. In colours, with Hills and contours.* (*In progress*)		
$\frac{1}{126720}$ or 2 miles to one inch selected areas for England and Wales.* (*In progress*) ...		**1s. 0d.**
$\frac{1}{253440}$ or 4 miles to one inch—General Map. Ireland. (*In progress*)		**1s. 6d.** Per Sheet for England and Wales. **1s. 0d.** Per Sheet for Scotland and Ireland.
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LIST OF LEAFLETS ISSUED BY THE BOARD OF AGRICULTURE.

(a.) Leaflets dealing with Insects and Fungi injurious to Crops.

No.	Title.	No.	Title.
1	Black Currant Mite.	38	Carrot Fly.
2	Vine, Plum, Hop and Raspberry Weevils.	41	Red Spider.
3	Turnip Fly or Flea.	46	Stem Eelworm.
4	Caterpillars on Fruit Trees.	47	Asparagus Beetle.
5	Mangold Fly.	48	Pea and Bean Thrips.
10	Wireworms.	49	Fruit Tree Beetle.
11	Daddy Longlegs or Crane Fly.	52	Gooseberry Mildew.
12	Gooseberry Saw Fly.	53	Pear Midge.
14	Raspberry Moth.	56	Canker Fungus.
15	Apple Blossom Weevil	60	Wood Leopard Moth.
16	Apple Sucker.	62	Pear and Cherry Saw Fly
19	Pea and Bean Weevils.	64	White Root Rot.
20	The Magpie Moth.	65	Small Ermine Moths.
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23	Potato Disease.	69	Tent Caterpillars.
24	Ribbon Footed Corn Fly.	70	Winter Washing of Fruit Trees.
25	Chafer-beetles or White-Grubs.	75	Root-knot Eelworm in Cucumbers and Tomatoes.
30	Codlin Moth.	76	Cucumber and Melon Leaf Blotch.
31	Onion Fly.	77	Finger-and-Toe in Turnips.
33	Surface Caterpillars.	86	Brown Rot of Fruit.
34	Woolly Aphis or Apple Root Louse.	87	Fungus Disease of Young Fruit Trees.
35	Celery Fly.		

(b.) Leaflets dealing with Wild Birds.

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(c.) Leaflets dealing with Animals, including Poultry.

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63	Destruction of Charlock.	85	Haymaking.
72	Purchase of Artificial Manures.		

Leaflets 7, 17, 37, 59 and 71 are out of print.

Copies of these Leaflets may be obtained free of charge and post free on application to the Secretary, Board of Agriculture, 4, Whitehall Place, London, S.W. Letters of application so addressed need not be stamped.

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GRADING AND PACKING FRUIT AND VEGETABLES.

Experience in modern business competition convincingly demonstrates the necessity for strict attention to every detail that will honestly enhance the value or facilitate the sale of all merchandise. With heavy expenses in production on the one hand, and low selling prices on the other, the margin of profit is often so small that the greatest care is requisite to prevent its complete obliteration. Competitors in other countries have observed the weak places in our methods, and have taken the fullest advantage of their discoveries. Warning notes have been repeatedly sounded by the more advanced of our own countrymen, and in recent years there has been some awakening to a knowledge of defects that militate seriously against success, and which can yet be either reduced in importance or completely removed. Perhaps no industry affords a more striking illustration of this than the one which is concerned in supplying the public with home grown fruit and vegetables. Intensive cultivation has been carried in many places to a high pitch of excellence, and British horticulturists pride themselves, justly, upon their skill as producers.

Admirable and necessary as the highest cultivation must always be, yet something more is required to ensure complete commercial success, namely, the conveyance of the produce in the best possible style to the market or to the consumer. It is at this point too many fail, and a material proportion of unprofitable sales is mainly attributable to neglect in presenting goods

in the most satisfactory manner. Proofs of this defect are evident in every British market, and commonly the produce of the home grower may be seen in direct contrast with that of his foreign competitors, to the conspicuous disadvantage of the former. It is the purpose of the following notes to give some directions that, with the exercise of intelligence in carrying them out, may assist in improving the selling value of both fruits and vegetables as produced in this country.

Grading Fruits.

To aid in performing this important but neglected operation to the best advantage, we must assume that the preliminaries of successful cultivation have received due attention. The selection of the best varieties, suitable sites and soils, with every possible care in protecting the trees from attacks of insects and diseases, demand the cultivator's utmost skill and unceasing watchfulness. Finally, in preparing for the actual work of grading, the method and time of gathering should receive the strictest attention, or much of the other labour will be reduced in value. It is not sufficiently recognised how readily all fruits are injured by rough handling. Even hard, unripe, apples and pears are soon bruised, and not only do these marks show as serious defects in the appearance of the fruits, but the keeping qualities are also affected. The rough, old-time practice of shaking apples from trees, or even knocking down those which cannot be easily reached, are, it is hoped, almost obsolete now, yet, judging by the condition of fruit consignments seen in our best markets, some very similar method must still be adopted. It seems a very commonsense view to take, that if fruits are worth the labour and expense required to grow them to their full development and maturity, they should also be worth the comparatively little extra care needed in removing them from the plants and preparing them for sale or use. The fact is, that if this attention cannot be given, it is best to discard all idea of making fruit-growing commercially successful in its fullest extent.

Apples and pears should be placed in the baskets at the time of gathering, not dropped in, as the contact between the fruits in this way is a prolific source of bruises. This applies to both

unripe and ripe fruits, but in the latter case still greater care is needed, and the more tenderly the fruit is handled the better.

To all the soft fruits, such as plums, cherries, strawberries, and raspberries, the same rule is applicable, and compression or rubbing by the hand in the act of gathering must also be avoided. It is advisable to employ shallow handle baskets for gathering purposes, and to have the bottom and sides padded with some soft, smooth material which will not impart any lint or hair to the surface of the fruit.

The time of gathering will depend partly upon the character of the fruit and the objects of the grower. Early apples for cooking are gathered as soon as they are large enough, but late varieties for keeping require to be left on the trees until fully matured. Early pears for eating must be gathered before they are quite ripe, and the earliest dessert apples need the same attention. Much judgment and experience are requisite in gathering the soft fruits, but as a general rule it is preferable to take them before they reach the last stage of ripeness, though they must be sufficiently matured to be in a marketable condition. With strawberries several gatherings are necessary, and in the height of the season they should have attention at least twice a day. Raspberries also frequently need daily gathering when the fruit is ripening and the weather is hot. Stone fruits, like plums and cherries, can be gathered when the bulk of the crop is in good condition ; but an early gathering of the most forward fruits is advisable on account of the advantage in market prices. Gooseberries can be dealt with at two different seasons, *i.e.*, when the fruit is green and when it is ripe. The earlier the former can be had of good size, the better the prices; and in the later stage the fruits should be large, of good colour, and in the best state for eating, but not so advanced as to be in danger of cracking. One general rule is applicable to all fruits, and that is, never, if it can be avoided, gather them when they are wet, especially if they have to be packed for sending a distance.

In preparation for sorting, the fruits should be taken and carefully spread on a table or bench which may slightly slope to the front, and should be of a convenient height for the packer to stand at. The soft fruits must be conveyed to the sorting

room in shallow trays or baskets, so that they can be graded direct without turning them out. When experienced hands are employed some degree of sorting can be done at the time of gathering, thus saving further handling or removal of the fruits, and the grower will in every case endeavour to reduce this to the minimum.

Several matters have to be considered in the actual work of grading, and an intimate knowledge of the characteristics of varieties is essential to the best results. The effects of seasons on large crops also demand attention, for the second grade of one crop might rank as the first in another. It is impossible to lay down a rule that would constitute a standard equally reliable under all conditions, but a general idea can be given of the relative values of different grades under similar circumstances.

The points of importance in classifying the best fruits are :—

1. Freedom from injuries and blemishes.
2. Good size and even form.
3. Colour.
4. High quality with ripeness.

The first two are essential to all high-class fruits, and no defective, distorted, or undersized samples should be allowed in the leading grades of any kind.

The third quality is a special one, which always possesses a marked value in fruits for dessert, and even amongst some used for cooking or preserving, as in apples, red currants, raspberries, and strawberries, for example. A richly-coloured sample, though only of moderate size, if free from defects, will often possess a higher market value than larger and duller fruits. Cox's Orange Pippin, for instance, if sold in two grades, one large and dull or greenish-yellow, and the other a size smaller, but in its best colour, will command the larger price for the latter ; and this is true of many other fruits where colour is a characteristic that is sometimes deficient in the larger sizes.

As regards the fourth point, mere size may also be a secondary consideration, provided the fruits are choice, in perfect condition for immediate use, and free from defects. This especially concerns small packages of dessert fruits, such as the finest pears, plums of the greengage type, ripe cherries,

peaches, and nectarines. A special market must be at command for such samples, or they should be sent direct to the consumers or retailers.

The bulk of fruit grading will, however, be mainly concerned with variations in size, provided the essentials of good form and freedom from defects be secured. It is of the utmost importance to ensure that each grade be as uniform throughout as close attention can accomplish, and then the full value of the work is most likely to be obtained.

The question is sometimes raised whether grading yields a profit to the grower sufficient to pay for the trouble, but a very moderate experience suffices to give an emphatic affirmative reply. Many proofs could be adduced, but here is one that illustrates the advantage. In an average season twenty bushels of Warner's King Apples were gathered for sale, and of these ten bushels were sold unsorted, just as the fruits came from the trees, at 4s. 6d. per bushel. The remaining fruits were graded and sold as follows:—

		£	s.	d.
3 bushels at 8s.	=	1	4	0
2 ,, at 7s.	=	0	14	0
3 ,, at 5s.	=	0	15	0
2 ,, 2s. 6d.	=	0	5	0
		£2	18	0
Ten bushels unsorted at 4s. 6d.		2	5	0
Cost of grading		0	1	0
Gain on graded fruits		0	12	0

The average price per bushel of the sorted apples was thus over 5s. 9d., as against 4s. 6d., the expenses of carriage and sale being the same in each case. Two bushels of defective fruits mixed with the others thus materially lowered the value of the whole consignment when sent in an ungraded state.

When dealing with choice fruits that can be sold in smaller quantities these differences are greatly magnified. At a time when several varieties of the best dessert apples were not bringing more than 12s. per bushel in central markets, a portion of the crop was sorted and realised at the rate of 23s. per bushel. For example, 10 dozen fruits of the best brought 1s. 6d. per dozen, and 8 dozen of another grade brought 1s. per dozen. Again,

with strawberries, a portion of a crop was sold ungraded at 3d. per lb., another portion of the same variety was sorted and sold in about the following proportion per 100 lb., namely—50 lb. at 6d., 20 lb. at 4d., and 30 lb. at 3d. Total, 39s. 2d. After deducting the extra expenses this was equal to a gain of £10 per per ton. Similar examples could be easily multiplied, but any ordinary season would afford such proofs. It is evident that if the largest importers find grading profitable, as they admittedly do, with so many disadvantages against them, the home grower ought at least to reap an equal benefit if he would only take the trouble. I have handled many tons of fruit, and should estimate the average increased price of graded samples, compared with that sold in bulk, unsorted, as ranging from 20 to 50 per cent., while the additional cost would vary between 5 and 10 per cent. on the difference in the gross returns.

A quick eye and some practice under good guidance soon enable a packer to select the various sizes in a uniform manner. Apples in particular can be readily graded into several sizes according to the variety and the crop. Occasionally four well-marked grades may be obtained, in other instances perhaps three are secured, and sometimes only two are obtainable. The difference of a quarter of an inch in diameter will constitute a well marked grade. An American Association has adopted as the minimum standard for first grade apples of the largest types 2½ inches diameter ; while for the smaller types 2¼ inches is the minimum diameter for first grade fruits ; in each case a ¼ inch is allowed between the firsts and seconds. In practice it is found almost impossible to adhere to such exact grading ; the general standard and range in size of the crop or variety must be judged, and the graduation founded upon this. These remarksespecially refer to apples for cooking, or dessert apples equally well coloured, but what has been already said about the value of colour must be remembered and a special grade selected of uniform size where there is a proportion of larger fruits deficient in that respect.

Most of the details regarding apples are also appropriate to the grading of pears, but as a larger proportion of these are used for eating than cooking, they are more adapted for disposal in small packages, and hence repay for the greatest atten-

tion in uniform grading. Several quantities can be usually obtained from one crop, and it generally pays best to sell in two or three grades, only those rejected in the selecting process being disposed of in bulk. Even when large crops from old orchard trees are being dealt with, a few dozens of the finest fruits carefully packed will help to raise the total returns considerably.

Stone fruits may be selected in various grades. Plums for cooking can thus be sorted into two or three grades, the largest fruit commanding the best market. A good medium size is in demand for bottling, and the smaller sizes are utilised in ordinary cooking or preserving. Dessert plums and cherries are readily graduated on the same method, the finest in boxes or small packages and the others in bulk.

Soft fruits, such as strawberries and raspberries, are worthy of equal care, the former being sorted into at least two grades and sometimes into more. The best are placed in punnets, the next in small boxes, and a third grade can be sold in boxes or baskets holding from 6 lb. to 12 lb. Raspberries may be conveniently divided into two qualities whenever a special sale can be commanded for the best fruits either in punnets or small boxes.

Nearly all other fruits also admit of some grading, even though it be only to the extent of excluding defective and malformed specimens; the results yield a satisfactory reward for the labour and expense.

Grading Vegetables.

The benefits derivable from careful and systematic grading are by no means confined to fruits, as vegetables also afford considerable encouragement to those who strive to make the most of them in the same direction. Especially is this the case with root crops, though in a general way the sorting adopted is of a very rough character. Potatoes, for example, are usually picked up in three sizes, the large tubers for sale, the seconds or sets, and the small tubers to be used as food for stock. The large size should be again sorted into two or three grades; it is with them as with apples, a comparatively small proportion of coarse irregular tubers spoil the appearance of a large consignment.

Even shape and uniformity of sample possess a distinct market value, and a medium sized potato having these characteristics, together with good quality, will bring a better return than huge distorted tubers of which size is the only recommendation. If an extra 6d. per bushel or £1 per ton can be secured by such care it often means with a good crop sufficient clear gain to more than pay the expenses of cultivation.

A distinction can be made between the best or earliest turnips and carrots and the ordinary quality or crop in bulk by marketing the former in bunches, while the latter are sent in bags or baskets. Onions, too, can be graded in several ways, the best being bunched or made into "ropes," while smaller sizes are sold loose, the smallest ranking as pickling onions. It is always advisable to have several sizes, each sample fairly uniform, as some buyers have a preference for medium size bulbs and others for large ones. In selling small quantities by weight the retailers have a difficulty with the largest onions, and usually find the medium size more convenient. If roots are prepared for sale by being thoroughly cleaned it is a great help, and in any case wherever grading is followed all the best qualities should be so treated or the chief part of the labour will be nullified.

Peas and beans should always be graded. Yet this is seldom done by the grower, and, as with many other vegetables, it is usually left to the retailer. Large, well-filled pods of the former are always in demand, and if the colour is good their value is enhanced. But they are too often gathered without due care, and a number of insufficiently developed pods materially lowers the value of the whole, while reducing future gatherings. Two or three grades of peas can be readily formed, according to the condition of the crop and the varieties, some being much more even croppers than others. In supplying consumers direct daily or at regular intervals, it is now becoming the practice to shell the peas, grade them by means of sieves, and consign to the purchaser in small boxes. Dwarf kidney beans and scarlet runners can be graded by selecting the long, straight, and even pods for the best samples, in smaller quantities, the bulk going for sale in bushel or half-bushel baskets.

With green vegetables, such as cabbages, savoys, kale and

Brussels sprouts the principal point is to see that each sample is uniform and in the best condition, which is largely a question of care in gathering. For ordinary markets the two first named must be large and with solid hearts; for special sale and for sending direct to consumers a smaller size, but possessing all the other essential characters, is often preferable. Brussels sprouts should always be sorted into two grades, all the firmest and most compact into one, and the looser, rougher sprouts into another; the increased price of the first will pay for this in the majority of cases. To cauliflowers and broccoli similar remarks apply; the most even and whitest heads constitute the first grade, the rougher and discoloured the second. As with cabbages, large heads are required in general markets, but for the best sales moderate-sized perfect samples are the most satisfactory.

Other vegetables or similar crops pay for attention in the same way. Rhubarb can be classed in two grades, the longest, straightest and best coloured forming No. 1 bundles. Celery may be divided into two or three grades, the heaviest and most solid in bundles for salad, the others loose for soups. Asparagus, too, should be placed in two or three grades, according to the length, substance and blanching; the smallest (Sprue) for soups; all the best in bundles of 25, 50, or 100, the last in larger numbers. Seakale can also be sorted, the best grown and whitest in bundles set upright in baskets.

Tomatoes demand the greatest care in sorting; two, three, and even four grades may be formed. The best in boxes or shallow baskets. The most even and brightest coloured fruits take the lead; there is a special demand for the largest handsome fruits in some markets, but the principal general sale is for good even-shaped, moderate-sized, uniform samples. Cucumbers are graded into two or three sizes; and vegetable marrows are also sorted, but in some places large specimens of the latter are most in demand, while in others a medium size is chiefly required.

Salading, like lettuces and endive, can occasionally be separated into two grades, according to the solidity and blanching of their hearts, but as a rule a uniform sample of one value is preferable, to be regulated by the gathering. Amongst many miscellaneous crops that cannot be particularised

mushrooms are conspicuous as needing sorting into different grades. The largest (and oldest) should be placed together; the medium-sized will constitute the best grade; and the smallest or "buttons" the next, both the latter being usually sent or sold in punnets, and the others in baskets.

The essential general rules in grading vegetables of all kinds are the following:—1. Exclude all immature, overgrown, coarse, or defective specimens from the leading grades. 2. Make each grade as uniform as possible. 3. Let freshness and fitness for use be the characteristics of all vegetables when consigned to market or consumers. To aid in all this grow only the best varieties obtainable, and watch closely for every real improvement on old sorts.

Packing for Sale.

Wherever fruits or vegetables have to be transferred a distance by road or rail, the best culture and most careful grading may lose all their value through neglectful packing. That many of the defects in market consignments are either due to this or materially increased thereby the majority of salesmen can confirm, and the complaints on this score are as frequent as those regarding inattention to grading. In dealing with fruits the essentials for success are as follows:—

1. Use only perfectly sound fruits.
2. Pack firmly, without crushing.
3. Use the best elastic odourless materials as packing.
4. Place all choice and ripe fruits in small quantities and shallow packages.

In the home trade baskets are much more extensively used than boxes, and the most common are round baskets without lids, of the bushel, half-bushel, or half-sieve types. They are strong and durable, but are objectionable for all the best fruits as, even with the most careful packing, the top layers are liable to be bruised, and under the usual careless methods they are certain to be damaged. When apples, pears, plums, cherries, or gooseberries are sent in such baskets a covering of paper, with straw or other material, is placed on the top and secured by cross pieces of willow or hazel, the points of which are forced through the sides of the basket below the rim. Flat

baskets with lids are preferable but expensive, and the difficulty with all these is that they must be charged for or returned. In extensive dealings with market salesmen baskets are supplied at very little cost to the producer, but where it is desired to promote more direct communication between the grower and retailer or consumer some other method is preferable, or the producer must provide his own baskets. It would be helpful in many districts if a local industry could be developed in cheap basket making; there are few places where the suitable willows could not be grown, and the basket making might be performed in the winter evenings. For useful information regarding willows and osiers suitable for the purpose named, see Leaflet No. 36 issued by the Board of Agriculture.

Much could be said in favour of boxes for fruits, and, where only small sizes are employed, they may be purchased or made so cheaply that they can be included in the price of the fruit, and thus all the trouble of returning or collecting empties is avoided. Their more general use under the right conditions would assist producers in two ways: first, by aiding them to avoid overstocking the markets in seasons of heavy crops, and, secondly, by facilitating direct communication with the consumers, thus securing a better price for their goods. In a small way, boxes can be made at home at a cost of 1½d. to 1s. each; on a larger scale, with the use of machinery, they may be turned out at about 8s. to 50s. per 100, according to the size, and boxes costing 1d. to 6d. can always be given with the best grades of fruit, usually even with profit. Many of the leading railway companies have recognised this fact, and now supply boxes of various sizes at 1s. 6d. to 5s. per dozen, while several manufacturers also supply to large orders at very reasonable prices.

The sizes kept in stock by the principal railway companies (such as the London and North-Western) and furnished to the order of producers on their systems, are the following (inside measurements):—

Average price			Length.		Width.		Depth.
1½d.	No. 1	=	10¾ inches	×	7¼ inches	×	3 inches.
2d.	,, 2	=	13 ,,	×	9 ,,	×	4¼ ,,
2½d.	,, 3	=	15¼ ,,	×	10¾ ,,	×	5 ,,
3d.	,, 4	=	16¾ ,,	×	11½ ,,	×	5¼ ,,
4d.	,, 5	=	18½ ,,	×	13 ,,	×	6 ,,
5d.	,, 6	=	21¾ ,,	×	14 ,,	×	7 ,,

Of these, the first four sizes are the most generally useful for fruits, the others may be utilised for salads, light vegetables, or flowers, but are hardly strong enough for the weight of fruit such sizes would hold.

Home-made boxes can be produced in any sizes to suit the growers' requirements, but these here named have been tried and proved satisfactory. Outside measurements are given, and full space is allowed for packing materials :—

Bushel—

Sides 23¾ inches long × 9 inches deep.
Ends 16 ,, ,, × 9 ,, ,,

Bottom and lid each in two pieces, 8 inches wide and 23¾ inches long leaving a slight space in the centre.

Half-bushel—

Sides 17 inches long × 9 inches deep.
Ends 11½ ,, ,, × 9 ,, ,,

Bottom and lid each in two pieces 6 inches wide and 17 inches long.

Peck—This is made in three sizes to suit different classes of fruit.

(1).

Sides 11½ inches long × 9 inches deep.
Ends 8½ ,, ,, × 9 ,, ,,

(2).

Sides 16 ,, ,, × 6 ,, ,,
Ends 10 ,, ,, × 6 ,, ,,

Sides 17 ,, ,, × 6 ,, ,,
Ends 8 ,, ,, × 6 ,, ,,

To follow these Nos. 1, 2, and 3 of the Railway Company's boxes are convenient, where shallow packages are needed for softer fruits.

Various materials are available for packing purposes, but much the best are the several grades of wood wool now prepared, the coarsest being suitable for large packages and heavy fruits, and the finest softest samples for the choicest and ripe fruits. But wherever it is to be in contact even with apples and pears only the softest make should be employed; the rougher samples can be used for the bottom, or filling up at the top. All choice and delicate fruits should be encircled with bands of folded soft tissue paper, having a glazed surface, which must be in contact with the fruit. This is also required to place over the top layers, but a stronger paper is used for unripe apples or pears.

In the actual work of packing, an even layer of wood wool is placed at the bottom of the box or basket, this being covered with a sheet of paper, and upon it the fruits to be disposed of are placed firmly. The best plums, pears, or dessert apples should never be in more than two layers, and in the smallest boxes holding one layer they travel in the finest condition. If only one layer of fruits is made, the packing material at the bottom, and that at the top, besides the folded paper band round each fruit, will be all that is essential; but if there are two layers, they must be separated by two sheets of paper, and sufficient fine wood wool evenly spread to prevent injury to the lower fruits, and form a firm bed for the upper ones to rest upon. From one dozen to four dozens of the best dessert apples, pears, or plums may be so packed in one box with safety for a long journey. Peaches, nectarines, and apricots must always be in single layers, and demand the utmost care.

Strawberries can be packed in from 3 lb. to 6 lb. of selected fruits, but the first-named quantity is the best for the finest fruit, and No. 1 of the railway boxes just holds that amount conveniently, allowing for a little packing material at the top and bottom, but use only leaves between the layers. The same size box will hold 4 lb. of best cherries, 3 lb. of raspberries without their stalks, 3 lb. red currants (closely packed), or 4 lb. of black currants; but the last two may be packed in 6 lb. to 12 lb. lots if not too ripe; the smaller quantities are, however, preferable and safer. The finest early strawberries should be packed in 1 lb. punnets, which may be either deep or shallow, round-plaited chip punnets, or square ones (with or without handles). The round punnets are best packed in trays with lids, and those generally employed will take six punnets. They are only used for the earliest and choicest fruits, when prices are good. Crates can be employed to hold several such trays, those large enough for six being a convenient size and weight. The square punnets are packed more closely together on sliding shelves, or in trays like the others in crates. Grapes are packed in shallow or handle baskets, the points of the bunches towards the centre and the stalks secured to the sides or rims, the top of the basket being covered with stout paper tied round the rim, or some handle-baskets are fitted with lids. The sides and base of the

baskets are sometimes padded, but are then always covered with a soft glazed paper. The great point is to avoid rubbing the surfaces of the berries and spoiling the "bloom," a character which, in its perfection, adds much to the selling value, as it does also with some plums.

In every case, besides ensuring the security of the finest fruit, endeavour to display it to the best advantage, and if the grade is uniform, as advised, this can be done quite honestly by the aid of a little coloured or white tissue paper to fold over the sides when the box is opened, and by arranging the fruits with the coloured side uppermost. The question of branding or labelling must be considered, for where good fruit only is being dealt with, the use of the words "Seconds" and "Thirds" is apt to give rise to a misconception that is unfairly against the seller's interest. For the finest samples, "Extra," "Select," or 'Special" may be employed. Some mark the next grade A1, and the next No. 1, or if the letter X is employed, three would be used for the first grade, two for the second, and one for the third. Another method is to term the best Selected No. 1, and the other grades Selected No. 2 and Selected No. 3. Something of this kind is needed to indicate that the lower qualities are not refuse, but properly graded fruits. A grower should adopt a uniform system, and adhere to it, so that his brand may become known and have a market value, and every package ought to have the name of the variety and quality boldly printed on the label. Growers who intend to make a substantial business, and who deal honestly in the best produce, should have their own names on the packages. Some salesmen object to this, but if a grower cannot make his business through the ordinary channels he must try fresh ones. Endeavour to supply the shopkeepers, or develop a trade with private customers and send direct to them. The reduced rates at owner's risk on the railways, and the parcels post afford ample means for enterprising men to work up a business in small packages of choice fruits if they take the trouble to do so, either by advertising, by circulars, or by trade letters.

In packing vegetables most of the general advice already given should be serviceable; but these are disposed of in larger quantities and therefore require a different class of packages.

Bags of various kinds and sizes, with large light open baskets or crates, are more extensively employed than boxes. The majority of roots are sent in bags, but the best samples of turnips, carrots, &c., that are bunched are sent in crates, while radishes and small roots are sent in baskets. Green vegetables like cabbages, are best in crates, as also are broccoli and cauliflowers, but the earliest and best of the last named are often packed in flat baskets or hampers and pay for every care The best samples of salading, such as lettuces, are usually packed in hampers, the rougher grades in crates. Peas and beans are packed in baskets, bushels, or half-sieves, but as previously noted peas when shelled are forwarded in small boxes containing about three quarts each. Half-sieves are also used for Brussels sprouts, pickling onions, and other small vegetables. The earliest rhubarb is consigned in hampers ; the later often goes to market in bundles loaded direct into the vans, or packed in crates, as also is celery. For all early and high quality vegetables shallow baskets or boxes are useful. Cucumbers, tomatoes, mushrooms, and many others can be conveniently sent in this way, and where periodical consignments of general vegetables are sent to private customers this is the best method. It is necessary to pack firmly as with fruits, and where green or perishable vegetables have to travel a long distance it is desirable to gather them as shortly before packing as possible, preferably in the early morning when quite fresh, but not when drenched with rain. They should not be allowed to remain exposed to sun or wind for some hours before they are sent off, as is sometimes the case, to the obvious disadvantage of the seller. Above all, do not on any consideration admit defective or decaying samples into the packages; maintain the uniformity so strongly recommended as regards fruits, and it will be found that the reputation gained is a satisfactory exemplification that "honesty is the best policy," though what is often stigmatised as dishonesty is a carelessness from which the producer suffers most seriously in the returns he receives.

R. LEWIS CASTLE.

CIDER FACTORIES IN FRANCE.

The United States Government recently appointed a special agent to study and report upon the manufacture of cider in Europe, and the results of this inquiry have been published under the title "A Study of Cider Making in France, Germany, and England," as Bulletin No. 71 of the Bureau of Chemistry of the United States Department of Agriculture. From this bulletin the following account of the factory systems, as applied to cider in France, has been taken, as they differ in some respects from those more commonly met with in this country:—

Considerable importance is attached to observing the maturity of the fruit. The French especially argue that both the sugar content and the quality of the product are affected thereby. The first will doubtless be readily admitted by all, and the second in part, but further investigation is needed before all that is claimed can be admitted. While the fruit should certainly be mature—that is, it should have reached the perfection of its growth—it should not be allowed to ripen and fall from the tree, as this will lead to very irregular ripening and yield at no time a satisfactory amount of evenly ripened fruit in proper condition for grinding.

The French lay great stress upon gathering and ripening in bulk, as they claim in this manner to secure the most perfect development of the delicate aroma which is such a marked characteristic of the best Normandy varieties. Their method is generally to dislodge the fruit by shaking and by the use of poles at about the stage of maturity which is recognised as right for gathering and barrelling. In many places this fruit is left in huge piles under the trees until late in the season, though this is not considered the best practice. The better method, which seems to be quite well observed by larger growers, and espec-

ially by those concerns which manufacture large quantities of cider, is to bring the fruit quite promptly into the lofts over the cider mills. This was the only house-storage method observed in France.

A characteristic of the French *cidreries* is the almost total absence of cellars. This is the rule in France, while just the opposite is true of Germany.

The simplest method of describing the better class of French factories is perhaps to take a single cider factory as an illustration. The best type of factory examined in the French cider country was that of an Agricultural Union at St. Ouen-de-Thouberville, a short distance from Rouen. This establishment, built and operated upon a co-operative plan, is a model in its mechanical appointments, and the technique of its operations seemed to leave little to be desired.

In total dimensions the building is approximately 300 ft. long by 100 ft. wide. To the rear of the main operating room of the ground floor one can step up a few feet into the main fermenting room, or down a few feet into a half-cellar, used for the finishing process of fermentation and for storage. The surface of the ground slopes from the front to the rear of the building, so that this lower room ends at ground level. This gives an important advantage in the ease with which the finished product can be loaded on trucks for transport.

The operation of this factory will be better understood by following the usual course of the fruit and must as they pass through the several processes to the finished product. The carts laden with apples in sacks enter the shed in front of the factory, and by a hoist, operated from the main shaft within, the fruit is lifted to the second floor, where it is weighed and put in bins according to variety and quality. These bins cover nearly all the second floor, and are only 18 in. deep, strict rules as to methods of storage being observed. With the fruit thus distributed it is possible to observe critically its condition and to grind as it comes to proper maturity; also the careful distribution in accordance with the quality makes it easy to blend the fruit so as to produce any desired grade of must.

When ready to grind, the fruit is measured to the machine in proper proportions. The grinder stands at the floor level of

this store-room. Formerly the fruit was washed, but now this is only resorted to in case of necessity. The fruit is, however, run over a slatted "way" or chute in its progress to the cylinders, and much trash is thus screened out, an attendant watching to see that foreign substances likely to damage the grinders do not pass. From the grinders the pulp drops into a chute, which delivers it as directed by the operator into one or another of the several pomace vats. The custom is to fill the vats one after another, the pulp being allowed to remain for some hours before pressing. This maceration of the pulp in its own juice is thought to aid in extracting the sugar content, and to give a better colour to the must through certain chemical changes caused by the action of the air on the crushed tissues. The pulp is not, however, and never should be, allowed to ferment before pressing.

The pulp vats at this factory are made of porcelain tiles carefully set in cement. A drain pipe is arranged to carry the must, which always flows from freshly crushed fruit, into a cistern at the left of these vats. From here it is pumped into the large casks in the fermentation room. A large vat is provided for the maceration of pomace after it has been through the press.

When the pulp is thought to be in condition for the press, a small car is run alongside, and the pulp is laid up in cheeses on a form, coarsely woven press cloths being used, just as is done in the best American factories. When this car is loaded it is run on to the press, and the hydraulic pump is put in motion ; the car and its load of pulp being lifted by the upward thrust of a hydraulic piston. In this factory the hydraulic presses were rated at 200,000 lb. direct pressure.

While this load of pulp is under pressure another car is loaded ready to take its place. On being released from the press the car is run alongside the large vat and the pressed pomace is discharged into it, carefully cut up with a shovel, and wet with weak must or water, the amount of liquor added being about equal to the pure juice expressed. This round of operations is repeated until the day's grinding is exhausted, and the pomace from the first pressing then rests in the large vat, macerating in water or weak must until thought ready for pressing a second time. The

must from the fresh pulp in the vats and cistern is united in the great casks of the fermentation room as pure juice. This is destined for the highest grade cider.

After eight to twelve hours' maceration the pomace is again subjected to pressure on a different press from that used for pure juice, and the must is received in another cistern near by and pumped into another set of casks. This must is used to make a second grade of cider, the *boisson* of the labourers. But this does not complete the operation. Again the pomace undergoes maceration with water or weak must, being then pressed a third time. The must from this pressing is very weak, its specific gravity being 1·010 to 1·016. This must is used to macerate the pomace after the first pressure, thus adding very materially to the quality of the must derived from the second pressing.

The pomace is no longer of any value for cider purposes. It may, therefore, be discharged by running the car outside the factory, or it may be ground anew and washed to separate the seeds, which return no small income, as they are in great demand by nurserymen for growing stocks. These seeds are known to commerce in the United States as French "crab seed," but they are really seeds of the cultivated apple and not of crabs.

A second method of extracting the juice from the apple pulp is also employed in this factory, viz., diffusion. The diffusion battery is located at the extreme left of the main operating room. It consists of six tanks about 3½ to 4 ft. high, mounted on a turntable. Immediately at one side, and just above the level of the tanks is a reservoir for water. This may be supplied warm or cold.

To put this apparatus into operation, five of the tanks are filled with cut or pulped fruit. These are so connected that the fluid will circulate from one tank to another by means of a tube connected at the bottom of the first and delivering the flow near the top of the second, and so on around the circle. By the time the fluid flows out from the bottom of the fifth tub it is well charged with the soluble matters contained in the fruit, *i.e.*, sugars, acid, tannin, mucilage, &c. But it can never be made to equal in richness the product of the first pressing from the same fruit.

As soon as the fruit in the first tank is exhausted by this washing with water, the stream is turned into the second, and the sixth tank, now freshly filled with pulp, is put in service as the final member of the battery. Then the first tank is emptied and refilled with fresh fruit to take the last place in the series, when the third tank becomes the first cell in the battery. Thus the operation proceeds indefinitely. It should be said that the richness of the must delivered at the exit from the fifth cell always determines when a fresh tub or cell must be "cut in," as the flow through the last tub of fresh fruit strengthens the must very much. The strength or richness is ascertained very readily by specific gravity.

The manufacture of cider by the diffusion method is carried on in France to a considerable extent, but its present importance does not appear to warrant extended discussion here. It may be worthy of study, but all the indications seem to point to its failure to produce a genuine high-grade cider.

In the factory at St. Ouen-de-Thouberville, two hand presses were provided as a reserve to be used in case of accident to the hydraulic presses.

The main operations prior to fermentation have now been outlined. The must of the several grades has been delivered by pumps to the large casks in the fermentation room. Through each section of this part of the building runs a main brass pipe connecting with the pumps. The flow is readily turned into the desired section by valve cut-offs, and in each section the must is delivered to the receptacles by rubber tubes which can be attached to the "main" at convenient points. Each cask as filled is marked with the date and such other data as are necessary to guide the operator in the details of the fermentation. At the same time, proper entries are made in the factory journal for future reference.

From the upper room, where the first fermentation occurs, the cider runs by gravity at first racking to the room below, which is a sort of half-cellar. Here it usually rests until it is finished cider. A railway runs into this lower room to carry the finished cider in casks of proper size for transportation to a platform at the lower side of the factory, from which they are rolled on to the carts without lifting—an important advantage.

There are five cisterns adjoining the lower store-room (which is of insufficient size), capable of augmenting the storage capacity by 60,000 gallons. These are made of slate laid in cement, and the cider keeps perfectly in them. When they are required, the cider flows by gravity to them from the lower store-room. They are carefully closed as filled, and only opened as it becomes necessary to pump the cider out for sale.

This factory has a total annual capacity of about 350,000 gallons.

A laboratory is attached to it where analyses of fruit and of the product at various stages of manufacture are carried out.

A CUCUMBER LEAF DISEASE.

Dendryphium comosum, Wallr.

For the last four or five years growers of cucumbers have suffered severely from the disease known as Leaf-blotch, caused by the fungus *Cercospora melonis.* (See Board of Agriculture Leaflet No. 76.)

This season another form of leaf disease has been met with, which, though rather similar in appearance to the Leaf-blotch, is found to be caused by an entirely different fungus, viz., *Dendryphium comosum*, Wallr.

This new disease was observed to appear as early in the season as March, which is about two months earlier than the time the ordinary Leaf-blotch disease first shows itself. It attacks the plants when quite young, and by killing the tissues of the leaf, causes small spots, which are easily detected; in bad cases the growing points of the shoots are also infected and destroyed.

The Dendryphium disease, as well as being interesting from a scientific point of view, should prove a warning to growers, as it affords an illustration of the way in which a disastrous epidemic may originate. *Dendryphium comosum* is a fungus long known to mycologists; it occurs on decaying vegetable matter, but always as a saprophyte, and there has never been any reason to expect this fungus to become parasitic, rather than any other of the numerous saprophytes with which we are familiar. It has found, however, in the cucumber plant a host on which it can readily flourish, at any rate under the conditions in which this plant is usually grown.

When these conditions are considered, it cannot occasion a moment's surprise that the cucumber is the prey of parasitic fungi. The warm, moisture-laden atmosphere of the forcing-pits is ideal for the germination of fungus spores and the growth of mycelium. The plants themselves, too, having been forced in

strong heat (and often grown in a soil, one part out of three of which is stable manure) are rendered "susceptible" to the attacks of fungi through the production of soft, rank, sappy growth, and are often weakened in their constitution.

It is true that the ordinary method of cultivation may appear to give the best returns, and that cucumbers have been grown thus for years with great success; but it must be remembered that it offers two conditions which tend to induce a fungus to become parasitic, namely, the providing of congenial surroundings and rendering the host plant susceptible to the attack.

Within the last seven years the cucumber has been attacked by two new leaf parasites, and unless these can be stamped out, or held in check by some means, the present method of culture may have to be altogether modified.

It seems very likely that Dendryphium was introduced into the cucumber houses by the manure that was used, and from thence spread to the cucumber plants. As before mentioned, it attacks the leaves, and generally forms small pale spots, which gradually increase in size, but are quite distinct from the blotches produced by Cercospora. The dead tissue of the spots often falls out, so that the leaves appear as if injured by the "shot-hole fungus." In bad cases, however, the fungus spreads considerably in the leaf tissue, and it may destroy all of it except the larger veins. When quite young leaves are attacked the vascular bundles may be also partly destroyed and curious malformations ensue. Spotting also occurs on the old leaves, and though the damage done to them is not generally quite so severe as in the younger ones, the destruction of leaf tissue is always serious to the welfare of the plants. In very bad cases the young shoots and fruits are utterly ruined by the fungus.

On examination of the spots with a pocket-lens a soft, velvety growth may be seen, though this may not be visible the first day the spots appear. The fungus, when once it has obtained an entrance into the plant, grows vigorously in the tissues, and after about two days the conidiophores (or spore-bearing hyphae) break through the epidermis and give the velvety appearance just alluded to.

Growers may have some difficulty in ascertaining whether it is Cercospora, or Dendryphium, or both, that is present in their houses, for the disease produced by the two fungi are rather similar in appearance in their initial stages, but their later development is quite different, and when once this difference is appreciated it is an easy matter to distinguish between them.

But quite apart from external appearances, the microscope will settle the question absolutely, provided spores are present. Dendryphium has minute oval spores, whilst those of Cercospora are long and multiseptate, and about ten times as large as those of Dendryphium. If it is wished to examine the spores, they will be found on the velvety patches on the leaf spots, but should there be any difficulty in obtaining them *in situ* they may be readily procured by placing some infected leaves in a moist chamber and leaving them for twenty-four hours; a good crop of conidiophores should then be visible on the spots, whether the fungus be Cercospora or Dendryphium.

The spores of Dendryphium when examined with the microscope are small, oval, or cylindrical bodies, 1—2 septate at maturity and nearly hyaline; they vary considerably in size, but the average is about $20 \times 6\mu$. Fig. 5 shows the spores magnified 400 times. (Fig. 7 is added by way of comparison to show the difference in form and size of the spores of Cercospora.) The spores are borne in simple or branched chains at the apex of the hyphae, and are produced in enormous numbers. They are capable of immediate germination, and artificial cultures have been carried out in the laboratory showing that the fungus is a true parasite.

The hyphae, which are short and septate, are pale brown in colour and 10μ in thickness.

It is probable that Dendryphium possesses a higher form of reproduction than that of the conidiospores just described, though up to the present time efforts to discover anything like a resting-spore stage have not been successful, but with a number of artificial cultures still under observation it is hoped that the other stage may be obtained.

Preventive Measures.

It has been repeatedly observed that this disease (in common

with many others) is most prevalent and spreads most in dull weather, and that during days of bright sunshine it will diminish or may almost entirely disappear.

This points to the fact already insisted upon, that atmospheric conditions are largely responsible for attacks of these fungi, and that when such parasites are present a slightly dryer and more buoyant atmosphere should be given so as to reduce as much as possible the chances both of germination of the fungus spores and fresh infection therefrom, though when once the fungus obtains a firm footing amongst the plants patience will be required before it can be eradicated.

Besides dryness, there is another factor of importance in connection with the fine weather which may also materially help to keep the disease in check, viz., light. It is, unfortunately, impracticable to supply a substitute for sunlight. But, at any rate, every effort should be made to imitate the fine weather conditions as much as possible, and even in the height of summer fire heat may be necessary if damp, dull weather prevail. These are points which must be largely controlled by the discretion of the cultivator, suggestions only can be given here.

With regard to spraying with fungicides, many of these have been tried, but without much success. This is owing, partly to the difficulty of ensuring that the fungicide reaches all the infected parts, and partly because the cucumber foliage as generally grown is not hardy enough to withstand any but very weak solutions.

As a preventative, it would be advisable to spray with a very weak solution of potassium sulphide (1 oz. to 3 gallons of water). This should certainly be done if the houses were infected the previous season; the spraying should commence as soon as planting out has taken place, and care should be taken to spray the under side of the foliage.

In clearing out infected houses in the autumn, dead leaves and other rubbish should be collected and *burned*. As the fungus grows readily as a saprophyte in the soil, it would also be advisable to wheel out all the old soil, manure, &c. A dressing of gas-lime should then be applied to the floor of the pits in order to kill the spores and mycelium, which are sure to be abundantly present. The wood work of the houses should also be thoroughly

cleansed, so that the start in spring may be as free from risk of infection as possible.

The remedy, as far as our present knowledge goes, seems mainly to lie in a method of culture (1) by which the foliage is rendered less soft and rank (specially before the plants come into bearing), (2) by supplying more ventilation, as, speaking generally, a good circulation of air not only hardens the foliage, but lessens the chances of germination of spores and subsequent infection of leaves.

So far, the area in Great Britain infected by Dendryphium is strictly limited. Leaflet No. 76 shews how the spread of the cucumber leaf-blotch fungus, Cercospora, was discovered, *in one instance at least, to be due to empty packing cases.* Cercospora is now doing wholesale damage all over England. Knowing therefore the ease and rapidity with which such fungus diseases spread, it behoves growers to do everything in their power to stamp out any newcomer, such as the subject of this paper.

Description of Figures.

Fig. 1.—Cucumber leaf showing pale spots produced by Dendryphium (slightly reduced in size).

Fig. 2.—Vegetative hyphae of Dendryphium (× 400).

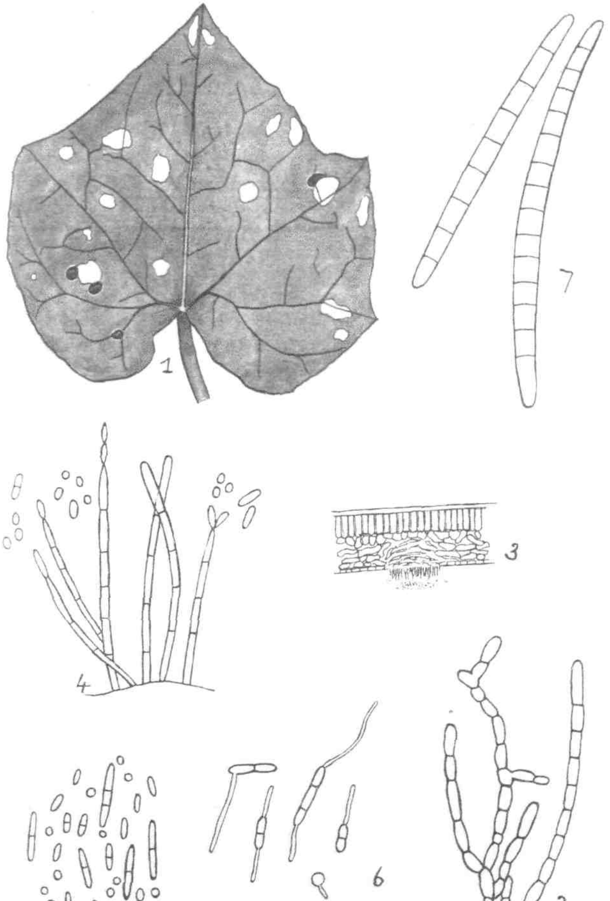
Fig. 3.—Section through portion of leaf attacked by the fungus showing conidiophores projecting from lower surface (diagrammatic × 180).

Fig. 4.—Conidiophores and conidia (× 400).

Fig. 5.—Conidia (conidiospores) (× 400).

Fig. 6.—Conidia germinating in water after 24 hours (× 400).

Fig. 7.—Spores of Cercospora showing size as compared with those of Dendryphium (× 400).



A CUCUMBER LEAF DISEASE.

THIRTY YEARS OF MILLING.

Milling history is so far simple that it is divided into two parts only. The first part begins, perhaps, B.C. 5000, and extends to A.D. 1873; the second part has less than thirty completed years behind it. To-day the majority of Englishmen still think naturally of flour as being ground between millstones, though it was as long ago as 1873 that Oscar Oexle demonstrated in London and Glasgow that the roller mill was at all events an excellent working method.

Thirty years ago milling was the occupation of some 15,000 mills in the United Kingdom—the great majority of them very small; in capacity for output that is to say, for they were often spacious enough in actual size. The average quantity of flour ground weekly in the mills of 1873 must have been singularly small, as judged by the present standard, when 300 sacks a week is considered a rate of production below which no mill would be deemed otherwise than small. But 3,000 mills, each producing 37,500 cwt. per annum of fifty "running" weeks, would have more than sufficed for our wants in 1873. The smallest mills were the windmills. These are now but an insignificant feature either in the landscape or in trade. The number of windmills which have become extinct since 1873 is probably not less than 5,000. They were economical, the motive power being supplied by nature in a cheap form, that is to say, with very little cost either of sails to catch the wind, or of machinery to bring the captured force to bear on the millstones. But they were capricious; no miller dependent on wind-power could guarantee delivery to date. He could take no work where time was of the essence of the contract.

The watermill was and is in a different position. The flow of water can be regulated for the most part quite satisfactorily though difficulties arise from high floods on the one hand, and

great drought on the other. The watermills are very far from being extinct, and there is, happily, no prospect of their extinction. The progress made in scientific stock-feeding has come to their aid, and since the progressive breeder and feeder of both animals and poultry finds meal, and rations including meal, more profitable feed than the unbroken raw food, he has become a steady customer of the small local mills, which grind cheaply and deliver economically. The owners of watermills in many districts where there are no big towns have moreover "saved themselves" by becoming in part distributors. If the average loaf to-day contains twenty-three parts out of thirty of foreign wheat, (this, or 76·6 per cent., is the average proportion shown on returns of home yields and imports respectively), the position of many watermills, with their small grinding capacity, will be well met. They will grind the seven parts of locally-grown wheat themselves, and they will buy the twenty-three parts of American or other foreign wheat, already ground by the nearest big town or port millers, and they will distribute the whole thirty parts as a complete delivery to the local bakers and to houses baking their own bread. Such bread will be excellent in flavour, strength, nutriment, and digestive quality, but the rough grinding in the ordinary local mill will cause the seven parts ground therein to be rather poor in colour. This, it is to be feared, is injurious to trade. The demand, especially of the poor, for the whitest of bread, is a survival of a very long established prejudice. From the Conquest to the end of the reign of Queen Anne, a period of 648 years, the consumption of rye in England was not less than a third that of wheat, and the dark-coloured bread was the badge of poverty. Rye is not *much* cheaper than wheat; the average difference does not exceed five shillings per quarter. But it is exactly these differences which strike the mind of the poor.

The number of mills in the United Kingdom began to fall from the very first introduction of roller mills, and it has been estimated that in 1883 there were 12,000 mills; in other words, ten years' fight with the roller mills had ended in 3,000 mills out of 15,000 going under. Most of them were wind, but some of them were water-mills.

The reason for this decisive success of the roller mill is *quite simple. It encourages the popular demand for a white* loaf. The millstone, in order to do its work of breaking down the grain, has to get up a periphery speed of nearly 2,000 feet per minute,* whereas rollers work well at 800 feet per minute. This sharper treatment of the grain in the stone mill is accentuated by the gritty surface and by the millstone furrows with their sharp edges, so that bran powder cannot be avoided by the millstone treatment. In advocating gradual reduction in mills Mr. Voller says:† "When the bulk of the flour is produced by the operation which also cleans the bran, discoloured flour is inevitable, hence gradual reduction scores heavily on this point alone by reason of the fact that under that system the bran is not finally cleaned till the bulk of the flour-yielding material has been removed."

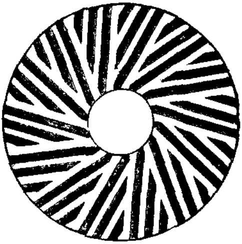
Gradual reduction, the process of putting the grain through a series of regulated rollers travelling not half as fast as the old millstone, adds vastly to the miller's control of his mill and its products, and in this single word *control* is to be found the whole secret of the roller's triumph. It is to be noted how the eminent technical authority speaks of "discoloured flour." The "discolouration" is assumed to be an obvious drawback, whereas it simply means a warmer or browner hue, which is due to a certain small admixture of a harmless and, indeed, valuable food. The trouble with the stone mill is not that it turns out innutritious flour—the very contrary is the case—but that the miller has an imperfect control of what it turns out.

It has been said that the twofold aim of all good milling is to produce bran without flour, and flour without bran; but this excellent dictum is too often read as though it meant that the modern *loaf* should contain not a speck of anything but the whitest flour.

It is sometimes asked if it be not possible to modify the millstone so as to enable it to meet the modern requirements, but the limit of possibilities is rigid. The illustration shows a typical millstone, the diameter of which may be anything from two to six feet—four feet would be about an average. It is

* *Modern Milling*, by W. R. Voller, p. 390. † *Idem.*, p. 392.

a stone from the well-known Burbage Quarries in Derbyshire; but while it is perhaps as good a stone as can be procured, it is not in any tangible respect superior to the burrstone used in the *Home Counties or the granite used in Cornwall. It will be* seen to have forty-two furrows, divided into fourteen groups of three; each group is called a harp, from its shape. If we were to reduce the number of furrows we should get a closer ground flour, but the gritty surface of the millstone itself is the main thing. The English custom, following that of the



Romans, who followed that of the Greeks, is to turn the top stone. But the Americans often run the lower stone. As the roller mill has conquered at least as rapidly in the United States as here the advantage of the change is not very apparent. Professor Kick, however, is a deservedly high authority in America, and I understand that in his lectures on millstone milling he has claimed for the under-running (1) better flour, (2) more work, (3) better distribution of feed, and (4) a quicker removal of meal. The matter is not unworthy of investigation.

The output of stone mills is increased by the use of exhaust fans, which, by removing the heated air, improve the quality of the flour, benefit the health of the operatives, and increase the mean rate of grinding, so that stones grinding 200 lb. an hour without an exhaust fan will easily grind 300 lb. with one.

The progress of *roller* milling may best be studied in the columns of that well-known technical journal, *The Miller*, which was established on 1st March, 1875, and contains as its first entry under "Patent Intelligence," the granting, on 16th February,

1875, of Patent No. 561 to Mr. Oscar Oexle, of Augsburg, for a roller mill. There are now 1,100 roller mills in the United Kingdom, and of these 850 have machinery ample for producing sufficient flour to meet our entire needs.

Porcelain rollers were in vogue from 1875 to 1880, but rollers of chilled iron were introduced about the latter date, and since then they have almost superseded the porcelain, their chief advantages being greater durability and truer surface. Improvements may be said with little, if any, exaggeration, to have marked the course of every successive year from 1880 to 1897, and 1898 witnessed the introduction of the automatic mixer. This ingenious appliance secures to the miller completely, regulating control of the rate of delivery from the different hoppers, so that a blend of, say, 15 per cent. English, 35 per cent. American Northern Spring, 20 per cent. of White Calcutta, and 30 per cent. of Argentine having been determined upon, and the revolving disc set to each hopper accordingly, the miller can leave the machine to make his mixture for him. The hoppers converge on a receptacle, through which runs a stirring or incorporating "worm" in rapid motion.

There is no reason that a comparatively small mill should not be, if not the mill of the future, at all events the most useful type in all but the great cities. Such a mill must, however, have rollers as well as stones,* and steam as well as water power. A small mill which is turning out 300 sacks a week is working well, but many millers will prefer to run day and night in favourable weather to running a level number of hours week after week. Practical men agree as to the dangers and general inadvisability of workmen being over driven at one time and reduced to loafing at another; but then experience shows that 10 per cent. more wheat will be turned out with a given amount of labour, in calm and frosty weather, than in an air saturated with moisture. Dry, still summer weather is about 10 per cent. better in the same respect than a London fog.

CHARLES KAINS JACKSON.

* As the mills having both will inevitably diminish, and the roller gives the fuller control, the stone mills are likely to go on declining in number. It is, of course, possible to employ rollers with a surface making a somewhat coarser flour than that now used for the so-called best bread.

AGRICULTURAL RETURNS OF 1903.

The preliminary statement giving the totals of the acreage under crops and grass, and the number of live stock in Great Britain, as returned by occupiers of land on June 4th last, was issued by the Board of Agriculture on 26th August. Similar information has been published by the Department of Agriculture and Technical Instruction for Ireland, and the particulars for both countries are brought together in the following tables. The total area under all crops and grass in Great Britain was 32,343,480 acres, or 44,479 acres less than the area recorded last year. In Ireland, on the other hand, the extent of land thus described increased by 3,543 acres, the total being 15,243,678 acres.

The areas under corn crops are shown in the table below. It will be seen that while the figures for Ireland for 1903 exhibit in the aggregate no appreciable variation from those of 1902, those for Great Britain declined by about 124,000 acres.

—	Great Britain.		Ireland.	
	1903.	1902.	1903.	1902.
	Acres.	Acres.	Acres.	Acres.
Wheat	1,581,587	1,726,473	37,654	44,244
Barley	1,858,484	1,909,383	158,768	167,877
Oats	3,140,242	3,057,203	1,097,512	1,082,144
Rye	59,064	68,379	10,038	9,638
Beans	239,655	243,101	2,075	2,318
Peas	181,511	179,751	289	347
Total	7,060,543	7,184,290	1,306,336	1,306,568

The area of land under wheat in Great Britain in 1903 was 1,581,587 acres, compared with 1,726,473 acres in the preceding year, a decrease of 144,886 acres or 8·4 per cent.; the acreage

thus reached was the lowest on record, with but one exception, viz., in 1895, when only 1,417,483 acres were returned. The decreased cultivation of corn crops was not limited, however, to a reduction in the wheat land. The area returned under barley in Great Britain was less than in any previous year, although the difference compared with 1902 was only 50,899 acres, or 2·7 per cent. of the total. Some portion of the arable land thus lost seems to have been devoted to the growth of oats, which occupied a greater extent of surface than in any year since 1895. The area accounted for as under this crop in Great Britain was 3,140,242 acres, or 2·7 more than in 1902. Notwithstanding this addition of 83,000 acres, the aggregate of 7,060,543 acres, which represents the extent to which the soil of Great Britain is occupied in the growth of corn crops, is smaller than has ever previously been reported.

The distribution of the remainder of the ploughed land, with the exception of the area sown with rotation grasses, is shown in the table below.

—	Great Britain.		Ireland.	
	1903.	1902.	1903.	1902.
	Acres.	Acres.	Acres.	Acres.
Potatoes	564,286	573,880	620,390	629,304
Turnips and Swedes	1,603,301	1,608,732	287,556	288,506
Mangold	401,627	441,458	76,005	77,051
Cabbage	64,803	69,039	44,539	42,333
Kohl-Rabi	19,297	23,937	—	—
Rape	99,004	100,285	3,774	3,797
Vetches or Tares...	144,966	172,150	2,663	3,061
Lucerne	60,355	53,673	} 24,851	26,341
Other Crops	106,935	104,734		
Flax	925	835	44,667	49,742
Hops	47,938	48,031	—	—
Small Fruit	70,152	75,378	4,596	4,309
Bare Fallow	351,126	293,131	5,140	5,235

This table affords, on the whole, further evidence of a diminution of arable cultivation. Potatoes, which account for an area of 1,184,676 acres in Great Britain and Ireland, occupy a land surface only slightly in excess of the minimum figure recorded for this crop in 1897. The area under potatoes in Ireland, which fell by 8,914 acres in 1903, has now steadily declined since the year 1888, when 804,566 acres were returned.

The area devoted to turnips and swedes in Great Britain was only 5,431 acres less than in 1902, a very trifling percentage on the 1,603,301 acres returned; but it marks a continuance of the persistent decline which has characterised this crop since 1893. Prior to 1887 it occupied annually at least two million acres, so that the diminution from the maximum amounts to about 400,000 acres. The area sown with mangold in the current year was only 401,627 acres.

Turning to the less important crops it may be noted that the loss of 27,184 acres devoted to the cultivation of vetches and tares represented a decline of 15·8 per cent., while cabbage, rape, and kohl-rabi each show a decrease, which, in the case of the latter crop, was equal to nearly one-fifth of its total area in 1902. The steadily-growing popularity of lucerne as a fodder crop in Great Britain is shown by the addition of 6,682 acres to the area devoted to its cultivation.

The particulars shown in the table below indicate an extension in the area of clover and rotation grasses kept for hay, 2,412,445

—		Great Britain.		Ireland.	
		1903.	1902.	1903.	1902.
		Acres.	Acres.	Acres.	Acres.
Clover and Rotation Grasses	For Hay ...	2,412,445	2,364,302	627,202	603,468
	Not for Hay	2,395,381	2,467,596	608,486	624,463
Total		4,807,826	4,831,898	1,235,688	1,227,931
Permanent Grass	For Hay ...	4,754,960	4,580,719	1,596,728	1,564,996
	Not for Hay	12,179,436	12,225,789	9,990,745	10,010,961
Total		16,934,396	16,806,508	11,587,473	11,575,957

acres being thus appropriated, or a higher figure than in any year since 1889. The area of these rotation grasses not kept for hay in 1903 reached a total of 2,395,381 acres, or 72,215 acres less than last year, and the smallest recorded since 1894. The figures for permanent pasture exhibit a similar tendency, the area devoted to hay in Great Britain being this year 4,754,960 acres, or no less than 174,241 acres more than in

1902. The area returned as not for hay declined by 46,353 acres, leaving a net increase in the grass land of 127,888 acres, which was sufficient to place the total for the current year considerably above the largest area previously recorded. The extension in the surface devoted to the hay crop is also a distinguishing feature of the Irish returns, and the figures for 1903 show that 55,466 more acres of meadow and clover were cut for hay than in 1902.

Turning to the statistics of live stock, the particulars relating to horses and cattle will be found in the following table :—

—	Great Britain.		Ireland.	
	1903.	1902.	1903.	1902.
	No.	No.	No.	No.
Horses used for Agricultural purposes*	1,106,448	1,076,170	364,657	358,312
Unbroken Horses :—One year and above ...	297,121	298,606	89,337	81,897
,, ,, Under one year ...	133,585	130,013	69,856	69,073
TOTAL OF HORSES	1,537,154	1,504,789	523,850	509,282
Cows and Heifers in Milk or in Calf	2,588,205	2,556,126	1,495,204	1,510,737
Other Cattle :—Two years and above ...	1,430,625	1,332,362	1,032,211	1,077,625
,, ,, One year and under two ...	1,368,134	1,385,776	1,036,244	1,067,705
,, ,, Under one year	1,317,646	1,281,712	1,100,509	1,126,154
TOTAL OF CATTLE	6,704,610	6,555,976	4,664,168	4,782,221

* Including Mares kept for breeding.

The number of horses used for agricultural purposes, including mares kept for breeding, in Great Britain was 1,106,448, as against 1,076,170 in 1902, while the number so returned in Ireland was 364,657 compared with 358,312. There was comparatively little change in the number of unbroken horses.

The number of cattle in Great Britain in 1903 was 6,704,610, or 148,634 more than were returned in 1902. This increase was made up by an addition of 32,079 cows and heifers,

98,263 cattle two years old and upwards, and of 18,292 younger animals, and although these figures were insufficient to raise the total to a number equal to that recorded in 1901, it is satisfactory to observe that there has been no continuance of the diminution in the total which was a noticeable feature of last year's returns. In the case of Ireland the very high figure of 1902, which considerably exceeded that of any previous year, was not maintained. A decrease occurred in each category and amounted in the aggregate to 118,053.

The following table gives the figures relating to sheep and pigs:—

—	Great Britain.		Ireland.	
	1903.	1902.	1903.	1902.
	No.	No.	No.	No.
Ewes kept for Breeding	9,879,101	9,999,171	1,576,191	1,653,306
Other Sheep:—One year & above	5,459,889	5,523,710	729,473	845,803
,, ,, Under one year	10,300,807	10,242,825	1,638,917	1,716,756
TOTAL OF SHEEP	25,639,797	25,765,706	3,944,581	4,215,865
Sows kept for Breeding	389,880	349,000	147,793	141,671
Other Pigs	2,296,659	1,950,567	1,235,679	1,185,939
TOTAL OF PIGS	2,686,539	2,299,567	1,383,472	1,327,610

The number of ewes kept for breeding in Great Britain in 1903 was less by 120,070, but the number of lambs was larger by 57,982, while the number of sheep over one year old was smaller by 63,821. The net result of these changes was a decline of one-half per cent. in the total numbers. In Ireland, however, the reduction of the total flock was more substantial, and amounted to over 6 per cent.

The number of pigs returned in Great Britain was 2,686,539, or 386,972 more than in 1902—an increase of 16·8 per cent.

AGRICULTURAL IMPORTS OF THE CEREAL YEAR.

The quantities and values of the principal articles of agricultural produce imported into the United Kingdom during the cereal year 1902-3, and the corresponding figures for the preceding year, are indicated in the tabular statement on the next page

The principal features in the imports of cereals was an increase of nearly 10,421,000 cwt. in the supplies of wheat. Of barley the receipts were also larger by 2,639,000 cwt., and there was a slight increase (64,000 cwt.) in wheat meal and flour. On the other hand, there was a falling off of nearly 5,615,000 cwt. in maize, and of 125,000 cwt. in oats.

The United States furnished nearly 32,000,000 cwt. of the wheat imported as compared with 41,600,000 cwt. in the previous year, but the decreased shipments from this source were more than counterbalanced by large supplies from Argentina, Russia, the British East Indies, and Canada, which sent us 11,856,000 cwt., 13,721,000 cwt., 11,907,000 cwt., and 11,470,000 cwt. respectively, these quantities being 6,883,000 cwt., 10,660,000 cwt., 4,479,000 cwt., and 3,163,000 cwt. larger in each case than in the previous year. There was a remarkable drop in the imports of wheat from Australasia, whence only 78,500 cwt. were received as compared with nearly 7,000,000 cwt. in the previous year. The United States contributed, as usual, the greater portion of the imports of wheat meal and flour, the quantity credited to the States being 16,018,000 cwt. out of a total supply of 19,180,000 cwt. The increase in the imports of barley were accounted for by large contributions from Russia, which sent us 11,997,000 cwt., an increase of 3,004,000 cwt. over the shipments received from this quarter in 1901-2.

There was an increase of 50,000 head in the imports of cattle, but a decrease of over 6,500 in sheep, and of over 5,700

ARTICLES.	1ST SEPT., 1902, TO 31ST AUG., 1903.		1ST SEPT., 1901, TO 31ST AUG., 1902.	
	Quantities.	Values.	Quantities.	Values.
		£		£
Horses ... ... No.	28,473	656,140	34,177	919,354
Cattle ... ... ,,	486,497	8,744,514	436,499	8,025,679
Sheep and Lambs ,,	319,430	497,012	326,015	498,674
Bacon ... ... cwts.	5,000,911	13,589,018	5,435,093	13,662,784
Hams ... ... ,,	1,203,825	3,323,425	1,622,559	4,098,338
Beef:				
Salted... ... ,,	167,440	261,057	176,644	257,681
Fresh ... ... ,,	3,854,438	8,024,445	4,068,525	8,361,784
Mutton, fresh ... ,,	3,864,600	7,608,167	3,723,340	6,833,924
Pork:				
Salted (not Hams) ,,	217,236	306,400	230,728	332,281
Fresh ... ... ,,	652,152	1,448,450	730,664	1,594,788
Meat unenumerated:				
Salted *or fresh* ,,	*660,527*	*1,213,853*	646,681	1,164,412
Preserved otherwise than by *salting* ... ,,	*746,259*	2,350,306	901,938	2,720,915
Rabbits ... ... ,,	487,343	759,663	406,078	670,943
Corn:				
Wheat... ... ,,	85,122,801	28,633,796	74,701,839	24,826,581
Wheat Meal and Flour ... ,,	19,179,674	8,866,287	19,115,628	8,730,420
Barley... ... ,,	25,697,400	7,180,942	23,058,390	6,484,041
Oats ... ... ,,	16,578,022	4,486,192	16,703,449	5,383,612
Maize ... ... ,,	41,587,582	10,862,647	47,202,169	12,370,843
Butter ... ,,	3,942,571	20,291,166	3,854,971	20,049,244
Margarine ... ,,	*896,838*	2,365,002	1,030,495	2,612,592
Cheese ... ... ,,	2,552,497	6,691,346	2,626,270	4,391,408
Milk, condensed ,,	923,329	1,772,051	896,222	1,785,587
,, *and cream, fresh* and preserved... ,,	—	—	21,751	37,464
Eggs ... gt. hundreds	19,546,242	6,470,581	18,583,297	6,145,233
Fruit:				
Apples ... cwts.	3,560,561	2,288,389	1,650,841	1,154,640
Pears ... ... ,,	442,718	425,908	307,722	259,946
Hops ... ... ,,	182,841	847,201	117,749	444,913
Onions ... bushels	8,437,814	1,003,795	7,287,670	970,561
Potatoes ... ... cwts.	6,124,753	2,028,364	5,082,992	1,472,491
Tomatoes ... ,,	1,026,306	902,766	763,019	677,994
Tallow *and Stearine* ,,	*1,319,494*	*1,939,314*	*1,870,308*	2,790,925
Wool ... ... lbs.	607,032,103	20,658,398	665,126,317	21,392,839
Hides, wet and dry ... ... cwts.	830,404	2,228,896	1,004,496	2,540,379
Lard ... ... ,,	1,660,565	4,080,355	1,713,343	4,070,306
Poultry and Game	—	1,151,972	—	1,050,357
Vegetables (unenumerated) ...	—	391,047	—	452,434

in horses. The larger supply of cattle was due to an increase in the imports from Canada, and to the renewal for a short period of the shipments from Argentina, which amounted to

27,817 head. The reduction in sheep was caused by a large falling-off in the numbers sent from the United States, which was not covered by an increase of 18,700 from Canada and the receipt of 82,941 from Argentina.

The imports of the following animal products decreased by the quantities indicated in each case: Fresh beef, 214,000 cwt.; salt beef, 9,200 cwt.; preserved meat, unenumerated, 156,000 cwt.; salt pork, 13,000 cwt.; fresh pork, 78,000 cwt.; bacon, 434,000 cwt.; and hams, 419,000 cwt. There was an increase of 141,000 cwt. in the supply of fresh mutton, and of nearly 23,000 cwt. in salted or fresh meat unenumerated. The United States provided as in former years the greater portion of the imported fresh and salted beef, bacon and hams, but of each of these articles the imports from this source were on a smaller scale than in the previous years. Denmark furnished 1,417,000 cwt. of bacon, and Canada 533,000 cwt. Australasia sent 2,078,000 cwt. of fresh mutton, and Argentina 1,399,000 cwt., these quantities being slightly larger in each case than those furnished in 1901-2.

There was an increase of 88,000 cwt. in the supplies of butter and of 27,000 cwt. in condensed milk, but decreases in cheese (73,800 cwt.) and margarine (133,600 cwt.). Eggs increased by 963,000 great hundreds, and poultry and game by over £100,000 in value. Denmark, France, Holland, Russia, and Canada were the principal contributors to the imports of butter, the first-named country being credited with nearly 45 per cent. of the total supply. The increased importation of eggs is due to larger consignments from Russia, whence we received 6,652,000 great hundreds.

There was an increase in the imports of fruit and hops. The supply of apples was more than double that of the previous year. Onions, potatoes, and tomatoes were also received in much larger quantities than in 1901-2.

Of wool, hides, tallow, and stearine we received smaller consignments than in the previous year.

AGRICULTURAL EDUCATION IN GERMANY.

An interesting report to the Foreign Office by Dr. Rose, H.M. Consul at Stuttgart, on the organisation of agricultural education in Germany states that the foundation of agricultural instruction in Germany was laid by Thaer, a doctor of medicine, at the beginning of last century. Since that time facilities for agricultural instruction have been provided throughout the country, and they may now be divided into the following categories :—

Advanced agricultural instruction :—(1) Independent agricultural colleges; (2) agricultural institutes at the universities; (3) other higher agricultural institutes; (4) special lecture courses for owners, managers, and farmers, &c.

Secondary agricultural instruction :—Agricultural schools.

Elementary agricultural instruction :—(1) Farming schools; (2) agricultural winter schools; (3) special lower agricultural *schools; (4) rural improvement schools; (5) special courses of* lectures.

The principal objects aimed at by the agricultural colleges and institutes are the instruction of future owners, tenants, farmers, and managers of large or small estates in all branches of theoretical and practical agricultural science; the theoretical and practical instruction of future professors, lecturers and teachers *of agricultural subjects; theoretical and practical* instruction in surveying and agricultural civil engineering; the training of future officials of the land administrative departments; and scientific research for the furtherance of agricultural progress and knowledge.

Three agricultural colleges in Germany are situated at Berlin, Poppelsdorf, and Hohenheim respectively. These

colleges are not self-supporting, but require substantial aid. In 1902 the Berlin College received £11,700, the Poppelsdorf College £6,000, and the Hohenheim College £9,400 in Government grants.

As regards scope of instruction, number of professorial staff and students, the Berlin Agricultural College is the largest and most important, and a description of its constitution and work may be taken as typical of those of similar institutions in Germany.

The college is under the direct supervision of the Minister of Agriculture, State Domains and Forests, and is managed by a rector, assisted by a curatorium, and the upper and lower professorial councils. The members of the "curatorium," generally two, are charged with the supervision of the scientific interests of the college and are nominated by the Minister of Agriculture. The upper professorial council consists of all fully qualified professors and a certain number of other not fully qualified professors, specially nominated by the Minister for this purpose. It serves as a general advisory board to the rector, and assists him in general matters of management. The lower professorial council consists of all professors, lecturers and assistants, and takes part in the determination of the courses of instruction for each half year; it is also empowered to propose general resolutions concerning the present condition, aims and future of the college.

There are, further, departmental councils for each of the three principal departments, viz., (*a*) agriculture, (*b*) geodetics and agricultural civil engineering, and (*c*) agricultural-technical industries. They are composed of the principal professors of each department, and their duty is to foster the development of their special departments to the best of their ability, and to apply to the rector or upper council for any further facilities they may deem necessary in the interests of instruction.

The usual agricultural course lasts from four to six terms (two to three years) and generally commences in the autumn. The course in geodetics lasts from four to five terms (two to two and a-half years) and commences after Easter; students of this latter course must produce leaving certificates of a higher preparatory school (classical or "real" gymnasium, or upper

"real" school), and proof of at least one year's practical work. The details of the courses of instruction are as follows :—

Term I. (winter):—General farming and cultivation I. (soils and drainage); general principles of breeding of animals; experimental physics (mechanics and heat); general experimental chemistry; mineralogy and minerals; anatomy and morphology of plants; zoology and comparative anatomy (vertebrata), useful and noxious insects, anatomy of domestic animals; agrarian affairs and policy; legislation relating to cultivation of land; practical work in the determination of minerals; practical microscopic work, with special reference to the anatomy of plants.

Term II. (summer):—General farming and cultivation II. (irrigation, meadow cultivation and manures); horse breeding; pig breeding; chemistry (repetition); geology and geognosy; botany and physiology of plants (including grass and fodder and practical determination of plants); zoology and animal physiology (domestic animals and general review); practical chemical work; practical physiological botany; law and State science (Imperial and Prussian law, with special reference to farmers, surveyors and agricultural civil engineers)

Term III. (winter):—Special farming and cultivation I. (fodder and cereals); agricultural management and book-keeping; cattle breeding; sheep breeding and wool production, with demonstrations; feeding methods; agricultural machines; meteorology; botany, including diseases of plants and preventive methods; seeds; veterinary science, including hygiene and contagious diseases of domestic animals; practical planting and knowledge of soils.

Term IV. (summer):—Special farming and cultivation II. (market produce); investigation and valuation of soils; agricultural valuation; history of German agriculture; cattle demonstrations; dairies; veterinary science, including internal diseases of domestic animals; skin diseases; horse shoeing; practical agricultural management; practical breeding; physiological and zoological work; exercises in national economy; optics and electricity (only for students taking the full three years' course).

Term V. (winter):—Soils and valuation; utilisation of forest produce; fruit cultivation; spirit and starch manufacture; adulteration of foods and fodder; agricultural utilisation of moors; animal physiology; practical chemical work.

Term VI. (summer):—Machinery and building constructions of agricultural allied industries (sugar manufacture, distilleries and breweries); land measurement and levelling; afforestation; vegetable cultivation; pisciculture; agricultural architecture; practical work in the agronomic and in another laboratory selected by students; practical determination and valuation of soils.

In addition to the above subjects of the regular six-term course further subjects are recommended which are mostly optional.

The full plan of instruction, which is arranged for a period of six terms (three years), is also adapted to students who take the shorter course of two years (four terms). A shorter period of study than two years is discouraged as productive of imperfect and faulty results, and is only permissible with the intention of refreshing or increasing the knowledge of certain special subjects hitherto neglected or imperfectly acquired.

The instruction given in the lectures is supplemented and assisted by practical work and scientific research work in the laboratories, collections and various institutes, and by demonstrations and excursions.

The examination for the certificate of agricultural science at the Prussian agricultural colleges, to which as a rule only students who have finished a prescribed course are admitted, is generally held at the end of each term. Other students may be admitted in special cases by special permission of the examination commission. The examination is conducted by a commission consisting of the professors who lecture on the subjects of examination, and is presided over by the director of the college.

Proof of at least four terms' study must be forthcoming on the part of the candidates. Of these terms the whole number may have been passed at any other agricultural college or university institute; a period of study at a technical college or university is accepted up to two terms if the subjects of study have been natural and economic science. The examination is partly written, partly *vivâ voce.*

Agricultural institutes are now attached to eight of the German universities. The following table gives the number of students at the university agricultural institutes for the year 1902, and also the amount of State aid granted to each institute :—

Agricultural Institute at the University of—	1902.	
	Number of Students.	Amount of State Aid.
		£
Breslau	46	1,800
Göttingen	75	935
Halle	196	6,150
Jena	49	—
Kiel	8	235
Königsberg	60	2,125
Leipsic	117	—
Munich	61	—

The details of the course of instruction given at the Munich university agricultural institute, which may be assumed to be

similar to that given at the seven other institutes, are as follows:—

First year: National economy; experimental physics; inorganic experimental chemistry including the elements of physical chemistry; organic chemistry; mineralogy; crystallography; general botany; special and systematic botany; comparative anatomy of domestic animals; general zoology; embryology and development of domestic animals. Optional: Chemical laboratory; microscopic laboratory; technical drawing.

Second year: Geology; chemistry and knowledge of soils; meteorology and climatology; physiology of animal organisms I.; nutrition of plants; general field and garden cultivation; meadow cultivation; diseases of garden and field plants; contagious diseases of animals; agricultural machines and tools; plant nurseries. Optional: Physiology of animal organisms II.; agricultural bacteriology; agricultural-chemical laboratory; microscopic laboratory; practical zootomic work; experimental agriculture (practical); valuation of soils; poultry breeding.

Third year: Special plant cultivation; feeding and fodder; general breeding and hygiene; special breeding; agricultural management; agricultural technology I. (fermentation industries, sugar and starch manufacture); agricultural technology II. (dairies); drainage and irrigation; agricultural constructions. Optional: Pisciculture; land reclamation; moor cultivation; agricultural calculations and estimates; agricultural experimentation; agricultural laboratory and agricultural-chemical laboratory; practical demonstrations on the experimental plots and estate and in the dairies; further in-breeding; practical agricultural civil engineering.

Special advanced lecture courses for owners, managers, agents and farmers &c., have been introduced during the past few years at several of the Prussian agricultural colleges and university institutes, and also in Saxony, Hesse, Würtemberg and other German States. They consist of a course, which is held during a week in winter, of from twenty-five to thirty lectures, dealing with the progress made during the past year in agricultural and natural science, in jurisprudence, political enonomy, and in all other subjects which are of interest and importance for owners, managers and farmers. The idea seems an excellent one; the owners, farmers, and managers travel to the college, remain for a week, and return to their estates after having attended the course of lectures and fully informed themselves of the annual progress made in all subjects bearing upon their profession. During the evenings discussions are arranged and thereby opportunities afforded for a useful interchange of opinion between practical agriculturists from the country and theoretical agriculturists from the colleges. Many high officials in the different administrative branches, for whom a knowledge of agricultural affairs is

of great value in the exercise of their duties, also take part in these lectures and discussions. The high rate of attendance at these courses, which sometimes amounts to 300 persons for one course, would seem to indicate that they are considered to be of great practical value.

Under the heading of other agricultural institutes are included *agricultural institutes which, whilst not occupying exactly the* same position as the agricultural colleges or the larger university institutes, yet possess a much higher standard of instruction than that of the agricultural schools.

The agricultural and brewing academy at Weihenstephan in Bavaria may be selected to illustrate this class of schools, of which there exist but few in Germany. The course of instruction aims at giving the students a thorough theoretical and practical training in higher agriculture and in brewing. The professorial staff of the school consists of eleven fully qualified professors, twelve other professors, lecturers, &c., who are engaged for certain branches of instruction only, and five assistants; the attendance for the year 1902 numbered 125 pupils. The facilities for practical work and scientific investigation are very numerous and varied.

Secondary agricultural instruction in Germany is given in the agricultural schools. The course of instruction is arranged for a period of six years, and the leaving certificate exempts the holder from more than one year of military service. The course is principally intended for the sons of farmers, managers and owners of estates who wish to acquire at the same time the qualification for the one year military service and a knowledge of practical agriculture. The schools are managed by a "curatorium," and are under the supervision of the Ministers of Agriculture and of Education. They are not State but semi-private schools, which receive pecuniary support from the State and various public and private sources. There are twenty-two schools of this kind in Germany.

In order to show in what manner the general ("real") school instruction and agricultural instruction are combined at these schools, the agricultural school at Döbeln in Saxony may be taken as an example, as it is one of the best of its kind.

To a certain extent the Döbeln School differs from the other

agricultural schools, as it is entirely supported by the State and connected with the "real" gymnasium, whilst the majority of the other German agricultural schools receive only partial support from the State, and, although they possess "real" classes, are not connected as a rule with the "real" schools. But as far as regards the plan of combined general and agricultural instruction given, it may well serve as an example.

The following table gives the subjects of instruction and the number of hours per week devoted to each subject; the duration of the course of each class is one year:—

Subjects.	Number of Hours per Week.					
	Lower School Division (General Educational Subjects).			Higher School Division (General Educational Subjects combined with Agricultural Subjects.		
	Class—					
	I.	II.	III.	IV.	V.	VI.
Religion	3	3	3	2	2	1
German	4	6	5	5	4	4
Latin	8	—	—	—	—	—
French	—	6	6	6	5	4
History	1	1	2	2	2	2
Geography	2	2	2	2	2	1
Arithmetic and mathematics	5	5	6	6	5	4
Elementary natural science	2	2	2	4	3	2
Physics	—	—	—	2	2	1
Chemistry	—	—	—	2	3	5
Agricultural production	—	—	—	—	3	4
,, management and political economy	—	—	—	—	—	3
Book-keeping	—	—	—	—	1	1
Surveying and plan-drawing	—	—	—	—	—	2
Drawing	2	2	2	2	2	—
Gymnastics	2	2	2	2	2	2
Singing	2	2	1	2*	2*	2*
Shorthand	—	—	—	2*	2*	2*

* Optional.

For the purposes of practical investigation and agricultural work, the school possesses various buildings and facilities, including an agricultural-chemical and a physical laboratory, a

large botanical garden, an orchard, several acres of experimental plots, &c.

Teachers of agricultural science at Prussian agricultural schools at which the normal plan of agricultural instruction is in force, must produce proof of the following qualifications:—(1) That they have completed the full courses of a gymnasium or upper "real" school; (2) that they have studied agriculture at an agricultural college or university institute for a period of not less than three years; (3) that they have been engaged in practical agriculture for a period of not less than two years; (4) that they have completed, with favourable results, a probationary period of one year as a teacher of agricultural science at an agricultural school.

It is a matter of some difficulty to classify the various schools and courses for elementary agricultural instruction in Germany. They consist of farming schools in which, in addition to the theoretical instruction, the pupils are largely occupied with practical farm work, and of lower agricultural schools, in which only theoretical instruction is given. These latter schools are again divided into schools with summer and winter courses, and into lower agricultural winter schools which are only open during the winter. As far as Prussia is concerned, these lower agricultural and farming schools for elementary agricultural instruction are under the supervision of the provincial governments, which support them financially when necessary. They have been partly founded by private enterprise, partly by towns and districts, and partly by agricultural associations. The course of instruction at the farming schools lasts from one and a-half to two years; at the lower winter agricultural schools two successive winter terms. Pupils entering these schools must have previously passed through an elementary school; they cannot acquire by the completion of the courses of instruction the right of one year military service, as is the case at the agricultural schools mentioned above.

In addition to all the schools mentioned, there exists in Germany a large number of special agricultural schools suited to the particular agricultural needs of each State and district.

Dr. Rose has selected the elementary agricultural schools of Würtemberg to illustrate the organisation and aims of the farm-

ing and lower agricultural winter schools. In considering them it may be remembered that the Kingdom of Würtemberg contains about one-thirtieth of the total German population and about one-twenty-seventh of the total area of the German Empire.

Farming schools, of which there are three in Würtemberg, are organised upon a uniform plan, under the supervision of the Ministry of Education and the Royal Bureau for Trade and Commerce at Stuttgart.

They are intended for the instruction of small peasants, small farmers and tenants, in practical agricultural work. Each school is managed by a director, who must be a farmer, and who rents from the State the farm attached to the school, and cultivates it at his own risk as a tenant of the State Domains; during his term of office and tenancy he possesses the rank of a Government official. He is assisted by an instructor, a farming inspector, and a veterinary surgeon.

The course of instruction lasts three years, and the number of pupil-labourers is generally limited to twelve; should there be less the director is not entitled to any compensation from the State, nor is he allowed to exceed the number of twelve without special permission. Intending pupils must be at least seventeen, strong and healthy, acquainted with ordinary farm work, and have passed through the lower preparatory schools. Special attention is paid to practical instruction, which includes almost every branch of farm work.

The pupil-labourers do not pay any fees, and they receive board and lodging free. The working hours are fixed at ten in the summer and eight in the winter; at harvesting times two hours more are required. Theoretical instruction is postponed until the brunt of the work is over. There are no regular holidays, but leave of absence for short periods may be granted, upon application, for special reasons. Lodgings, furniture, bedclothes, and washing utensils are supplied by the State; food is provided by the director as an equivalent for the work performed.

The Würtemberg agricultural winter schools, of which there are eight, are only open, as their names imply, during the winter months. They are intended for the sons of small holders who

have left school and wish to become farm workmen, or for small farmers. The various courses are carefully framed with a view to consolidating and extending the education acquired at school, and to giving such instruction in agricultural work as will enable the pupils to understand the principal agricultural processes on small farms. Intending pupils must have attained their fifteenth year, and show a satisfactory degree of educational ability.

Two courses are held annually. The fees are moderate, amounting to about £1 5s. per course. The schools are under the supervision of the Ministry of Education and Royal Bureau of Trade and Commerce; the expenditure is borne principally by the State, but the communities in which the schools exist are required to stock them with furniture, and to light and heat the schoolrooms.

In addition to the instruction provided in these elementary schools, provision is made for lectures to be given in villages by travelling teachers and experts. These travelling lecturers are to be found, not only in Würtemberg, but in the whole of Germany. It is their duty to disseminate useful agricultural knowledge in all directions, even in the most inaccessible quarters, to induce the peasants and small farmers to make agricultural experiments on a small scale, and to assist them in doing so in every manner. Some of the travelling lecturers are delegates or officials of the Chambers of Agriculture, or of the larger agricultural societies, from which quarters their remuneration is drawn.

OPENINGS FOR BRITISH AGRICULTURAL PRODUCE IN SOUTH AFRICA.

At the request of the Board of Agriculture, Mr. Birchenough, the Special Commissioner appointed by the Board of Trade to inquire as to openings for British trade in South Africa, has furnished a report with regard to the prospects of developing a trade in the South African Colonies in British pedigree stock and in other agricultural produce, from which the following information has been extracted :—

Breeding Stock.

In reference to the conditions affecting breeding stock in South Africa, Mr. Birchenough states :—There is probably no country in the world where cattle are, at the best of times, subject to so many pests and diseases. During the war, horse sickness, rinderpest, red water, blue tongue, lung sickness, &c., were rampant. Fences had everywhere been destroyed in order that they might not interfere with military operations, with the result that stock of all kinds ran together and infectious diseases spread with extreme rapidity. When the process of repatriation began the Government found itself face to face with two tasks—to re-stock the denuded farms and to stamp out the existing disease. These two processes are still going on. Cattle have been imported from the neighbouring Colonies and from Argentina, Texas, Queensland, and Madagascar. The important point has been to supply farmers with animals of some kind so that they may get to work upon their land. Although the countries from which supplies have been drawn have been carefully chosen for the similarity of the conditions there prevailing, it is obvious that the stock brought into the new Colonies must be

very mixed, and some time must elapse before it can be weeded and the process of grading up begin. It must not be forgotten that the majority of farm buildings—such as they were—as well as the fences, were destroyed or injured during the war. Until these are rebuilt it will be quite impossible to take proper care of valuable breeding stock. British pedigree animals are delicate, they have generally been stall-fed at home and shielded from all rough conditions, so that they easily fall victims to such diseases as red water and gall sickness. Mr. Birchenough was informed that in the best of times the records of the importation of live-stock into South Africa were mainly chronicles of disaster. Even in Natal and Cape Colony, where conditions are much more favourable, farmer after farmer told him that high-priced bulls and rams frequently died within a few months of their importation, and before any use had been made of them.

It has been found better to introduce stock of British origin by way of Argentina, Texas, or Australia, because in the second generation such stock has become acclimatized to conditions similar to those prevailing in South Africa. All experiments are being very closely watched, so that well-founded conclusions may be formed as to the animals which are most suitable for the new Colonies.

Mr. Birchenough reports, however, that there is no doubt whatever that in many districts of the Transvaal and of the Orange River Colony there is promise of a very prosperous, though not sensational, future for horse breeding, mule breeding, cattle raising, and sheep farming; and that, as soon as the present unfavourable conditions have passed away, owners of pedigree stock in Great Britain may count upon finding in these Colonies a very considerable market. It must not, however, be forgotten that fancy prices will for a long time be beyond the reach of private purchasers.

In Natal and Cape Colony there is already a certain demand for British pedigree stock, which is likely to increase as the farmers become more prosperous, although the same tendency to import the second generation from countries in which they have become acclimatized prevails. The past year was a very favourable one for stock breeders in Cape Colony, and they

obtained very good prices, owing to the demand for young *animals to restock the* Transvaal and Orange River Colony.

Instructions have been given to the correspondents of the Intelligence Branch of the Board of Trade to watch for, and report *upon, openings for the introduction of breeding stock* of all kinds. They have been also asked to notify at once any regulations or restrictions upon the importation of live stock and other agricultural produce into the different Colonies. The importance of speedy information upon the latter point has been specially pointed out to them, as such regulations vary in each Colony, and during the prevalence of disease are frequently modified.

The suggestion of the Board of Agriculture that the Land Departments of the new Colonies should be furnished with lists of names and addresses of breeders registered in the Herd and Flock Books of the principal Live Stock Societies in the United Kingdom was warmly welcomed.

Seed Potatoes.

The bulk of the seed potatoes imported into these Colonies are of Continental growth, although they are generally shipped through London. Mr. Birchenough was informed by several importers that the best variety of all, and the one which has, so far, given the most satisfactory result, is the French Early Rose, which comes from Bordeaux. The German Blue is an excellent potato, grows well, and yields a good crop. Its chief fault is that its lasting property is much less than that of most hard-skinned potatoes. Other favourite varieties which are imported both from the Continent and Great Britain are the Magnum Bonum, which is said to be a good keeping potato—the demand for it, however, is declining because it is rather a late crop ; the King of the Earlies, which is grown very largely in up-country districts, and has the great merit of keeping right through the winter without any special care ; and the Up-to-Date, which is becoming popular, as it suits the soil and has fairly good keeping qualities. This list has no pretensions to be exhaustive, and is only given as an indication of a few well-known sorts which have proved successful.

English seed potatoes are considered superior in quality to their foreign rivals, but they are much higher in price—in some instances as much as 50 per cent. If they could be delivered at anything like the same price they would speedily find a large market. Great care should be taken with the packing for export. The potatoes should be hand-picked and thoroughly dry; 66 lb. net weight is the quantity preferred in a case. The boxes or crates should be well ventilated, and shippers should be instructed to stow them in a suitable place on board so that the seed may not suffer. There are some complaints that the British packing is less satisfactory than the French and German. It should be remembered that freight plays a large part in the landed cost of seed potatoes, so that the packing should be as light and as little bulky as possible so long as it affords efficient protection to the seeds.

In illustration of this point it may be well to mention that the freight, primage, &c., upon a 66 lb. box of potatoes from England to, say, Port Elizabeth, amounts to 2s. 9d. per box; so that if the f.o.b. cost is, say 3s., the c.i.f. cost at Port Elizabeth is 5s. 9d., or nearly double. Any unnecessary increase in the size of the cases only served to increase the c.i.f. cost at the port of landing.

With the agricultural development of the new Colonies, and the great increase in the demand for foodstuffs at Johannesburg and elsewhere, there is sure to be a steadily increasing demand for seed potatoes. English growers ought to do their utmost to obtain a larger share of the trade, especially while there is so strong a feeling in the Colonies in favour of British produce of all kinds.

Agricultural Seeds.

There is every prospect of an increased sale for agricultural seeds; the immense reduction of live stock will drive farmers into growing foodstuffs and fodder wherever their land is suitable. Even in those parts of the conservative Cape Colony where the harvest has been good this year, disastrous as it has been elsewhere, farmers are showing a desire to obtain a better seed and improve the quality of their crops. *Wheat.*—The great enemy of wheat in South Africa is rust, and the object of

all growers is to find a seed wheat which will withstand rust. The Cape Government is at the present time importing "Rietti" seed wheat. It is a dark wheat, gives good results and, so far, has withstood rust. If it continues to be successful the western province will again become a great wheat producing district. Quite lately two shipments of seed wheat have been brought from Great Britain to Cape Colony, although some persons feared they would prove too soft. *Rye Seed* is imported from France, Germany, and Great Britain. This crop is used for feeding horses and mules. *Seed Oats* are imported from Australia, and give excellent results. The seed was originally sent to Australia from Algeria. *Barley* is grown from local seed. *Lucerne* seed comes from Germany and from Great Britain, and succeeds admirably in a few districts, yielding three and four crops a year. With irrigation it would become one of the largest feeding products of South Africa. *Grass Seeds* will sell well in certain districts when irrigation is more extensively adopted.

South African farmers have not yet been educated to such crops as swedes and beetroot, but they will come to them in time. They are very conservative, and it is difficult to persuade them to try anything new. They feed their cows on bran and chaff, their horses on Colonial forage, such as oat hay—never on beans or oats. They are only just beginning to make use of oil cake.

It is important to note that 20 per cent. is deducted from the railway rates quoted upon imported seeds for the Transvaal, provided that a certificate properly endorsed is furnished to the effect that the consignment is *bona-fide* seed for agricultural purposes.

Hops and Malt.

Hops are imported mainly from Great Britain and Bavaria, but the bulk of the imports come from Great Britain, and the same remark applies to malt. This is a trade which may be expected to grow considerably.

Cheese.

There is already a considerable sale for English cheese, but it is confined to the better class trade. Cheddar and Stilton are

the best known brands, and they compete with Gruyere and Gorgonzola. For ordinary consumption Dutch cheese is the most popular. By far the greater part of the cheese imported comes from Great Britain, but it appears to be of American, Canadian, and foreign origin, treated and packed in London. There are several brands of Dutch cheese (Gouda and others) made up in England in 2 lb. tins, which are very popular.

There is no apparent reason why the sale of British cheese should not be largely increased, if the cheaper varieties were carefully prepared for the South African market and due regard were paid to make up and packing. At present there is no serious attempt on the part of South African farmers to supply the local market.

Bacon and Hams.

By far the greater part of the bacon and hams imported into South Africa come from Great Britain. A certain proportion is of British origin, especially of the better qualities. The general practice, however, is for British firms to bring over what may be called their raw material in brine from the United States, Canada, and elsewhere. It is then cured or "finished off" in England, packed in salt, stitched in canvas, and despatched to its destination in lots weighing 224 lb. net or about 400 lb. gross. The trade appears to be in the hands of a few well-known curing firms. There is also a considerable sale for Westphalian hams. Lately some of the Cold Storage Companies have begun to import pork from Australia, and have set up curing establishments in South Africa. Until South African farmers take up pig-breeding and feeding upon a large scale the demand for foreign hams and bacon will go on increasing. In ordinary seasons, when mealies are cheap and plentiful, the Orange River Colony and parts of the Transvaal would appear to offer excellent opportunities for pig raising, and these Colonies ought to export instead of importing if they can overcome the difficulties of curing satisfactorily. Meanwhile British merchants may look forward to an increasing sale either for British produce or for foreign produce cured and packed in England.

In the case of all kinds of agricultural produce, instructions have been given to correspondents of the Intelligence Branch of the Board of Trade in all the South African Colonies to pay special attention to the classes of provisions which are likely to interest British producers and to report promptly and frequently upon all openings for new imports or for the increase of existing imports. Correspondents have also been requested to make constant enquiries as to local requirements, maximum quantities suitable for packages or cases, method of packing, and all kindred questions.

AGRICULTURAL AND MISCELLANEOUS NOTES.

THE VALUE OF ROOTS IN CATTLE FEEDING.

Experiments have been carried out at the County Demonstration Farm of the Northumberland County Council, Cockle Park, for two winters in succession, for the purpose of comparing swedes, as regards (1) cost, (2) efficiency, with a substitute manufactured from seeds hay, maize meal, and treacle in feeding to cattle.

These experiments were conducted under the scientific direction of the Agricultural Department of the Durham College of Science, and the results are published in the Annual Report issued by the Education Committee of the County Council.

Sixteen yearling cattle were used for each experiment: all the animals had been reared on the farm, had been weighed regularly from birth, and not only were they of the same weight and character when the experiment began, but for the previous six months each lot had made similar progress. In the case of the cattle used in 1901–2, the average weight did not differ by more than 7 lb. on any weighing day between June 15th and November 30th, the day on which the special feeding began.

Before beginning the experiments the cattle were carefully accustomed to the foods which they were afterwards to consume.

There was no case of illness. Every animal made good progress. Towards the end of the second experiment one animal was removed, but as nothing was wrong with it the increase made by it to the day of its removal has been recorded.

In the experiment of 1900–1, the cattle in Lot 1 received, along with other foods, 56 lb. roots, while the cattle in Lot 2 received only 28 lb. roots and a substitute for the remaining 28 lb. In the report on this experiment for 1900-1, it was

stated that the cattle of both lots did equally well, that the substitute cost 9s. 8d. per ton of roots saved, and that the ration fed to Lot 1 was to be preferred to the ration fed to Lot 2.

In 1901-2, the experiment began on November 30th, and continued, for all the animals (with one exception) until April 28th, when two from each lot went to market. The others were sold at various dates up to June 16th. The cattle in Lot 1 received 28 lb. swedes, along with 3 lb. linseed cake, 1½ lb. maize meal; ½ lb. treacle; ⅛ oz. spice; and hay. The cattle in Lot 2 got the same foods as Lot 1, except that in place of the 28 lb. swedes they got 2¾ lb. seeds hay, ½ lb. maize meal, and ¾ lb. treacle. The total cost of feeding Lot 1 for the experimental period of 165 days was £6 12s. 2d. per head; the cost of feeding Lot 2 was £6 18s. 5d. The roots consumed per head by Lot 1 amounted in 165 days to 41¼ cwt., which at 4d. per cwt. cost 13s. 9d. The food substituted for roots in Lot 2 cost £1.

The cattle in Lot 1 produced 13 lb. more beef per head than those of Lot 2, and though owing to a rise in prices Lot 2 made ¼d. more per lb. the actual returns from Lot 1 were 7s. 2d. per head more than from Lot 2.

The net result, therefore, was that the animals in Lot 2 cost 6s. 3d. per head more to feed, and were worth 7s. 2d. per head less when marketed, so that there was 13s. 5d. per head more profit in Lot 1 than in Lot 2.

It is to be noted that in the previous year's experiments, when only half the root ration of 56 lb. was replaced by other foods, the substitute was found as satisfactory as the roots replaced, for the two lots of cattle were of equal value at the end of the experiment; but in 1901-2, when the entire root ration of 28 lb. was withdrawn, the substitute was by no means so satisfactory, since at the end of 165 days' feeding the cattle in Lot 2 were worth 7s. 2d. per head less than those fed on swedes.

The conclusions drawn from the experiments are that though well-bred yearling cattle may be fattened without roots on the rations given to Lot 2 in 1901-2, this ration is not recommended but that at least 28 lb. of swedes should be fed daily, and 42 lb to 56 lb. may be given with profit.

In these experiments, during the fattening period live weight

increase was made at a cost of 44s. 6d. per cwt. for Lot 1 and 51s. per cwt. for Lot 2. The cattle were very good, and as the ration fed to Lot 1 was a moderately good one, it is not easy to see how the cost of producing beef in yearlings can be less than 40s. per cwt. in winter. If it does cost this sum, it is pointed out that farmers who hope to make anything out of feeding cattle must pay much less per cwt. for "stores" purchased in autumn than they expect to make for fat cattle sold in spring.

EXPERIMENTS WITH POULTRY FOODS.

The experiments with poultry conducted during the past two years in Cornwall, under the direction of the Technical Instruction Committee of the County Council, included a series of interesting trials with various cereal foods, the results of which are regarded as being reliable for seasons such as 1902, with frequent showers and rather low temperature. The fowls with which the experiments were conducted were hatched in the County Council pens, and, being Silver Wyandottes of the same age and strain, the conditions in these respects were equal; the conditions as to housing, runs, and shelter were also uniform throughout.

Thirty pullets were selected and divided into six pens of five birds each. The nature of the food given to each pen of five pullets and the number of eggs laid is shown in the statement below :—

Number of Pen.	FOOD CONSUMED.	Number of Eggs Laid in each Quarter of 1902.				Total Number of Eggs Laid in 12 months.	Total Laid during last nine months.
		January, February, March.	April, May, June.	July, August, September.	October, November, December.		
5	½ Maize, ½ Oats	215	251	197	69	732	517
1	Wheat	290	234	141	58	723	433
6	Maize	219	224	157	48	648	429
4	⅔ Oats, ⅓ Maize	213	253	121	46	633	420
3	Oats	217	213	94	21	545	328
2	Barley	199	158	55	35	447	248

Broadly speaking, all the pens which received maize held relatively better positions during the last nine months of the experiments than in the first three. As will be seen, the pen fed on wheat, which laid seventy-one eggs more than either of the other pens in the first three months, fell to second position with only four eggs more than the pen fed on maize in the last nine months, and eighty-four less than Pen 5 fed on half maize and half oats.

The results obtained with Pens 2, 3, and 4, were not considered to point to the probability of either of the foods tested being ranked as good. In the case of the other pens, it is observed that while Pen 6, fed on maize, produced only 648 eggs, as against 723 laid by the hens fed on wheat, the fact that wheat and maize were equal in the last nine months pointed to the latter food being a strong competitor. On the other hand, though wheat lost ground relatively to certain other foods during the latter part of the experiment, it was considered not improbable that it might generally prove, as shown in the experiment, the better food during the first three months of the year. This point appeared to be of such importance to the Technical Instruction Committee that arrangements were made to continue the experiments in the first three months of 1903, with the three pens Nos. 1, 5 and 6, around which special interest centred. The results of these latter experiments are shown below.

The following table shows the results for the three pens up to the 31st of March last, and if the figures for the last nine months of 1902 are brought into consideration, it will be seen that in the twelve months ending March, 1903, the fowls fed on equal weights of oats and maize laid 701 eggs, or 140 more than were laid in the same period by the fowls fed on wheat alone, while between wheat and maize there was a difference of fifteen eggs only in favour of wheat.

These results are held to show that in experiments with poultry foods the results of the first few weeks may be misleading, as the mixed food, which was beaten at starting, steadily improved its position after the first three months, the fowls fed on this food having laid 40 per cent. more eggs in the last three months than the fowls fed on wheat.

Week ending	Number of Eggs Laid.		
	Pen 1. Wheat.	Pen 5. ½ Maize. ½ Oats (by weight).	Pen 6. Maize.
January 3rd	—	—	1
,, 10th	5	5	4
,, 17th	6	5	5
,, 24th	4	5	5
,, 31st	7	5	3
February 7th	6	5	0
,, 14th	7	14	0
,, 21st	10	19	7
,, 28th	12	22	10
March 7th	12	25	15
,, 14th	13	28	19
,, 21st	17	24	20
,, 28th	20	20	20
,, 28th to 31st	9	7	8
	128	184	117

With regard to the financial results, the following table shows the weight and cost of the food consumed by each pen, the number and market value of the eggs laid.

Number of Pens.	FOOD.	No. of eggs laid between Jan. 1st and Dec. 31st, 1902.	Market value of eggs.	Weight of food consumed in 12 months in lb.			Cost of Food.	Profit.
				January 1st to June 30th.	July 1st to December 31st.	Total.		
			£ s. d.				£ s. d.	£ s. d.
1	Wheat	723	2 14 10	290	301	591	1 14 5¾	1 0 4¼
2	Barley	447	1 12 4¼	249	257	506	1 10 4	0 2 0¼
3	Oats	545	1 18 2½	272	269	541	1 10 3	0 7 11½
4	⅔ Oats ⅓ Maize ...	633	2 5 6	280	277	557	1 10 4	0 15 2
5	½ Oats ½ Maize ...	732	2 15 1¼	289	280	569	1 10 6½	1 4 6¾
6	Maize	648	2 7 8¾	235	221	456	1 3 6	1 4 2¾

The cost of the grain used is calculated upon the prices paid

in September, which were:—Oats, 17s. per 304 lb.; barley, 24s. per 400 lb.; wheat, 28s. per 480 lb., and round maize, 24s. 9d per 480 lb.

It is held that if the results of these experiments are adverse to the adoption of any theory as to the proper ratios of nitrogenous to non-nitrogenous substance, they throw some light on the question as to the value of the different grains. This is especially true of barley, with its disappointing results, and if the figures of Pen 3 are compared with those of Pens 4 and 5, it would appear to be true of oats when used alone.

Pen 4, with one-third maize substituted for the oats, laid eighty-eight eggs more in the twelve months than Pen 3, fed on oats only, and when the percentage of maize was still further raised to one-half, the difference in the number of eggs laid in the twelve months was no less than 187, or 34 per cent. in excess of the number laid in the pen fed on oats alone.

Oats, therefore, proved an admirable poultry food when mixed with an equal weight of maize, but the value of this mixture was reduced when the proportion of oats to maize exceeded one-half. The superiority of this mixture over all other foods in these experiments is emphasised by taking the figures for the year ending 31st of March last. In this period, Pen 1, wheat alone, yielded 561 eggs; Pen 6, maize alone, yielded 546 eggs; and from Pen 5, mixture of half maize and half oats, 701 eggs were obtained.

EXPERIMENTS WITH BUFFALO GLUTEN FEED.

In the month of January, 1902, a supply of Buffalo Gluten Feed was placed at the disposal of the Board of Agriculture, in order that its value might be tested as a fattening food for live stock. In order to subject the material to a comprehensive trial, the Board distributed the feed, in one and two-ton lots, to the various agricultural colleges, and also to a large number of landowners and farmers, who were invited to utilise the feed in feeding stock on their farms, and to furnish the Board with a

statement of their opinion as to its feeding value, with as much precision and detail as the varying circumstances would permit.

The following is a short *résumé* of the contents of the eight reports received from the agricultural colleges.

In three cases the substance was fed to bullocks; in no instance is the report very favourable. The most favourable report states that "it is about equal to a mixture of barley meal and undecorticated cotton cake"; whilst another report, from quite as reliable a source, states that "it is decidedly inferior to a mixture of decorticated cotton cake and barley meal." The third report states that "it is unsuitable to feed by itself, and should be mixed with other more palatable foods," and that "there is reason to suspect that Gluten Feed affects the quality of the beef." All seem to think, however, that Gluten Feed would make a useful feeding stuff in case of shortage of home-grown or artificial foodstuffs.

From an institution which used the feed for cows it is reported that "cows did not take readily to the 'Feed.' One cow refused it altogether, while another would only take it when mixed with cake. The standard of butter-fat in the milk from the cows when getting the Feed was much above the average. Satisfactory also as a flesh former. It compares very favourably with decorticated cotton cake as a rich milk-producing food, though not its equal as a beef producer."

A report on feeding it to yearlings says that "when everything is taken into account, the 'Gluten Feed' has proved itself the most economical of all the foodstuffs tried."

As regards sheep, one of the reports states that "the results of the experiments were throughout distinctly in favour of the 'Gluten Feed' over the other substances tried"; whilst another report states that "it gives better returns than gram (an Indian horse corn) and grey peas, and that at £5 10s. per ton it is an economical food for sheep if fed under suitable conditions. Sheep, however, are not fond of it and it is too dusty to be fed alone, but would do very well if mixed with a feeding cake."

In two instances it was fed to pigs. One of the reports states that "Gluten Feed, when fed to pigs, is capable of producing a slightly better effect than an equal quantity of

bean meal"; whilst the other report states that "the pigs did remarkably badly," and that "they have frequently had pigs give considerably heavier weights in from two to four weeks' less time." They had no hesitation in saying that "the pigs did not like the Gluten Feed, and though they became accustomed to it as the experiment proceeded, they did not eat it readily at any time."

At one other college no accurate results were obtained, owing to various changes on the college staff at the time of the experiment. It was, however, stated that pigs were the only stock that would eat the Gluten Feed.

The following is a short *résumé* of the contents of the thirty-five reports from landowners and farmers.

In twenty-two cases the Gluten Feed was fed to bullocks and fattening stock generally. A favourable impression was created in thirteen instances, four were doubtful, and five gave a distinctly unfavourable report. A few quotations will show how very conflicting are some of these reports from the practical farmers, and how very different is the impression that this substance has created in various parts of the country. "Animals fed on Gluten Feed brought 5s. 6d. per head more when sold." "If obtainable at a reasonable price, a welcome addition to the list of feeding stuffs. It was eaten with relish." "Cattle do not like it much, and will only eat it if fed with other foodstuffs." "Cattle did not like it at first, but relished it afterwards." "Unsatisfactory for fattening stock." "Quite ordinary food, and unsuitable for high-class feeding." "Very little use for bullocks, unless mixed with other foodstuffs." "Fattening bullocks would only eat it when mixed with other foodstuffs." "All stock fond of it." "Cattle relish it and do well; useful to take the place of home-grown meals in years of shortage." "Ate the Gluten Feed readily." "Fat bullocks did not seem to relish it; store bullocks ate it well; it is a good food provided cattle are begun on it, but they do not take to it well after having had other nitrogenous foods." "Bullocks fed on linseed cake and meal did the better." "Very much relished by stock; all appeared to thrive; consider it a sound food for stock." "Valuable and economical food; valuable adjunct to our commercial foodstuffs." "All stock liked it and did well on it;

consider, however, as good results could be obtained from other feeding stuffs at less price."

It will be seen from the above, that in some cases the food was apparently relished; in some the cattle required to become accustomed to it before it was appreciated, and in others it was necessary to disguise it with other foodstuffs before the cattle would eat it. Some farmers distinctly say that it is unsatisfactory for fattening; and others definitely welcome the food as a valuable addition to our foodstuffs.

Fed to young cattle, Gluten Feed gave satisfaction in four cases, but unsatisfactory results in two cases.

The following examples may be quoted as a result of feeding to milch cows:—

"Cows receiving 'Gluten Feed' held their own at the beginning of the trial, and latterly, towards the end of the experiment, made considerable gain over those receiving other foodstuffs." "Cows tired of the 'Feed' at the end of six weeks and would not eat it." "Gluten Feed disagrees with stock and causes diarrhœa." "Readily eaten by cows, and the milk was increased in quantity and quality." "No increase in quantity and quality of milk." "Would prefer half the quantity of decorticated cotton cake, or even less." "Increase of milk considerable." "Would not eat it kindly at first, but subsequently took it with avidity, and yield of milk was increased and flesh put on." "Appeared to like the Feed; general improvement in their condition, and the quantity and quality of the milk improved." "Gluten Feed, when taken to or appreciated by the cow, encourages the flow of milk, but does not contribute to the laying on of flesh during the period of lactation; quality of the milk not improved."

It will be seen from the above that here again there is much disagreement. In some cases the cows appreciated the food, and in others the cows would hardly touch it. In one case it proved itself to be a very laxative food. Sometimes the quantity of milk was said to be increased, and sometimes not.

In four cases the "Feed" was given to sheep. Two reports were favourable; one was indefinite, and the other unsatisfactory.

Two reports of feeding to swine were favourable and two unfavourable.

In one case it was given to horses, and the report states that "horses will only eat it in small quantities, when well disguised with chopped hay and corn."

In another case it was given to poultry, and the report states that "they did well on it."

CALF REARING EXPERIMENTS.

The *Journal* of the Department of Agriculture for Ireland for June, 1903, contains an account of experiments conducted by the Department in the rearing of calves. The object of the experiment was to test whether:—(1) Whole milk, which is the most natural and the most perfect food for a calf, is also the most economical food, and (2) whether it is as satisfactory and more economical to use, instead of whole milk, separated milk plus some substance which will take the place of butter-fat—the constituent of milk removed by the separator.

The experiments were commenced in 1901, when four lots of calves were reared on the following rations, viz.:—Lot I. Whole milk. Lot II. Five parts of separated milk with one part whole milk. Lot III. Separated milk and cod liver oil. Lot IV. Separated milk and Indian meal (ground maize). In addition to these rations, each lot of calves received an allowance of pure linseed cake.

County Sligo was selected as the centre of the operations, since an abundance of separated milk could be purchased from the creameries, and as that part of the country was free from calf disease. The calves were purchased at fairs in Counties Sligo and Roscommon and in the Dublin Market in the month of May, 1901. The animals purchased were drafted into four lots as equal as possible in respect of weight, quality, age, and sex. There were seven calves in Lot I., whose average age was four weeks; eight in Lot II., average age five and a-half weeks; nine each in Lots III. and IV., average age five weeks.

After the experiment had been in progress eight weeks it was deemed advisable to begin the weaning of the oldest calves in

each lot, and these ceased to receive milk after twelve weeks of experimental feeding. The majority, however, were not weaned until the end of the twentieth week of the experiment, and as this longer period constitutes a fairer test of the influence of the rearing rations, the results obtained from these calves are more reliable and are here considered apart from the results obtained in respect of the calves which received milk for only twelve weeks.

The calves under experiment were of the cross-bred short-horn type. From May 27th, 1901, until June 12th, 1901, when the calves were weighed for the first time, the rations of the various batches were gradually changed to those which they were to receive during the course of the experiment. The rations fed to each lot of calves during the summer of 1901 and up to the time weaning was completed are shown in the table below. The last two columns deal with the actual weaning period.

Lot.	Ration.	June 12th to June 24th.	June 24th to July 8th.	July 8th to Oct. 2nd.	Weaning period.	
					Oct. 2nd to Oct. 16th.	Oct. 16th to Oct. 30th.
I.	Whole Milk, quarts ...	5	6	6	4	2
	Linseed Cake, oz.	4	6	8	10	16
II.	Separated Milk, quarts ...	4	5	5	3	1½
	Whole Milk, quarts ...	1	1	1	1	½
	Linseed Cake, oz.	4	6	8	10	16
III.	Separated Milk, quarts ...	5	6	6	4	2
	Cod Liver Oil, oz.*	1½ to 2	2	2 to 2½	2½	1¼
	Linseed Cake, oz.	4	6	8	10	16
IV.	Separated Milk, quarts ...	5	6	6	4	2
	Indian Meal, oz.	4	6	{ 8 to Aug. 21 / 12 to Oct. 16 }	12	6
	Linseed Cake, oz.	4	6	8	10	16

* The allowance of cod liver oil is expressed in fluid ounces, 160 oz. = 1 gallon.

Throughout the season the calves had the run of eight statute acres of fair grass land, and were housed at night. They were tied to be fed twice daily, morning and evening. A good supply of water was available on the pasture.

The separated milk was delivered once per day from the creamery, and until used was set in barrels of cold water. The milk fed in the evening was usually perfectly sweet, but the morning feed was more or less sour. The milk was given at a temperature of from 80 to 90 degrees F. Up to July 1st the linseed cake (together with the Indian meal, in the case of Lot IV.) was steeped in hot water twelve hours before being used, and was mixed with the milk at feeding time. From July 1st onwards the linseed cake was given after the milk to the calves in Lots I., II., and III. For Lot IV. the cake and meal were mixed and then moistened with warm water or milk. The measured allowance per head of cod liver oil fed to Lot III. was put into a bucket and the milk then poured on the oil. This is the best method of mixing the milk and oil. Well refined oil of a good quality was used, and the calves showed no dislike to the mixture.

The average weight per head of the calves in each lot on June 12th, 1901, and the average gain in weight from June 12th to October 30th, were as follows:—

	Average weight on June 12th.	Average gain in weight in 20 weeks to Oct. 30th.
Lot I.	137·0	238·6
Do. II.	145·3	198·3
Do. III.	137·8	176·2
Do. IV.	137·4	180·2

The calves reared on whole milk made the largest increase; their average increase in weight per head was 40⅓ lb. greater than the average increase of the calves reared on a mixture of separated and whole milk, which gave the second highest returns. There was but little difference in the weight gained by the calves in Lots III. and IV., but their increase was about 20 lb. per head less than that of the calves in Lot II.

These results must be considered from a financial standpoint, for the question of most importance to farmers is not so much

which calves show the highest increase in live weight, but rather which have cost least per unit of weight gained.

A financial statement is given below for each lot of calves up to the time weaning was completed. In this table the cost of whole milk is reckoned at 4¾d. per gallon, separated milk at 1d. per gallon, cod liver oil at 4s. 3d. per gallon, linseed cake at £8 15s. per ton, and Indian meal at £6 6s. 3d. per ton. The cost of the hay and grazing is assumed to be equal for each lot, and is not taken into account, as it would not be sufficient to seriously affect the comparative results.

From the tables below it will be seen that though whole milk (Lot I.) gave much the largest increase of live weight per calf, this increase was obtained only at a far greater expense than the increase produced by the three other rations used. Of the three rations containing separated milk the one with Indian meal (Lot IV.) showed the cheapest returns. Next comes the mixture of five parts of separated milk and one part of whole milk, whilst the mixture of separated milk and cod liver oil proved the dearest of the three rations which contained separated milk.

The figures thus far considered apply only to the rearing period previous to weaning, but the experiments were continued for the purpose of testing how the method of feeding in the earlier stage of rearing (*i.e.* up to weaning), influenced the further development of the calves.

From October 30th onwards all the lots received the same rations and were otherwise similarly treated. During the winter 1901-2 and until May 12th, 1902, the daily ration per head was —1 lb. linseed cake, 1 lb. crushed and dried oats, and rye grass hay *ad lib.* The calves were fed twice daily with cake and oats, half a pound of each being given in a dry state at each feed. Whilst eating the allowance of cake and oats the animals were tied, but were allowed to run loose in the houses during the remainder of the time. They were driven out into the yard twice daily for water, and occasionally had a run on the fields.

From May 13th, 1902, to November 6th the cattle were put to grass, and from October 3rd onwards, when the supply of grass was short, they received a little cotton cake.

During the second summer (*i.e.* in 1902) the batch of calves which had received cod liver oil in the rearing period showed the largest increase. Next come Lots IV. and II., whilst Lot I. did not thrive so well as the remaining three lots, though they did better than the latter in the rearing period and in the winter 1901–2.

Lot.	Rearing Ration.	Average Weight in lb. per Head, June 12th, 1901.	Average Gain in lb. per Head.				Average Weight in lb. per Head, Feb. 16th 1903.	Average Total Gain in lb. per Head during entire Experiment.
			1st Summer, June 12th to Oct. 30th.	1st Winter, Oct. 30th 1901, to Apr. 16th 1902.	2nd Summer, Apr. 16th to Nov. 6th	2nd Winter, Nov. 6th, 1902, to Feb. 16th 1903.		
I.	Whole Milk ...	137.0	238·6	166·7	232·9	122·4	897·6	760·6
II.	Separated and Whole Milk...	145·3	198·3	137·3	265·2	103·7	849·8	704·5
III.	Separated Milk and Cod Liver Oil	137·8	176·2	125·7	281·9	114·7	836·3	698·5
IV.	Separated Milk	137·4	180·2	132·9	270 0	126·5	847·0	709·6

In November, 1902, the cattle were sold, but the feeding of the cattle during the winter 1902–3 continued under the supervision of the Department. The cattle were tied in stalls and received turnips, cake, and corn, a little treacle, with hay *ad lib.* About 2 lb. of chopped hay per head per day was mixed with the pulped turnips, and ½ lb. treacle per head per day was dissolved in hot water and thrown over the turnips and hay. Sufficient turnip, hay, and treacle mixture for two days was prepared at one time. The cattle continued to drink a little water up to December 15th. They were fed at 6 a.m., 11.30 a.m., and 5 p.m. in the following order:—First, cake and meal mixture; secondly, mixture of turnips, chopped hay, and treacle; and, thirdly, hay. For the two first weeks the cattle were given 45 lb. of the turnip, hay, and treacle mixture, and 4 lb. cake and meal per head. These quantities were gradually increased to 84 lb. and 6 lb. respectively. The

weights and gains of the various lots during each of these periods is shown in the table above.

Some of the cattle were sold on February 17th and the rest on March 17th, 1903, at an average price of 34s. per cwt. live weight. They were not sold in a fat condition, but were sent by the buyers to Scotland to be finished. Reckoned at this price per cwt. on the average live weight on February 16th, 1903, the average value per head of the cattle in the various lots was as follows :—Lot I., £13 12s. 6d.; Lot II., £12 18s.; Lot III., £12 14s.; and Lot IV., £12 17s.

Lot.	Rearing Ration.	Cost of Rearing per head during the first 20 weeks.	Saving per head effected as compared with Lot I.	Difference in value per head in favour of Lot I. at close of Experiment.	Net saving effected per head as compared with Lot I.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
I.	Whole Milk	3 19 5	—	—	—
II.	Separated and Whole Milk	1 11 8	2 7 9	0 14 6	1 13 3
III.	Separated Milk and Cod Liver Oil ...	1 9 7	2 9 10	0 18 6	1 11 4
IV.	Separated Milk and Indian Meal ...	1 5 8	2 13 9	0 15 5	1 18 4

At the end of the experiment Lot I. were therefore worth from 18s. 6d. to 14s. 6d. more per head than the cattle reared on separated milk and a cream substitute. This superiority in value bears, however, no proportion to the extra cost incurred in rearing Lot I., as shown above.

As already stated, the tests described above refer to the calves which were not weaned until the end of the twentieth week; but some of the oldest calves in each lot began to be weaned after August 7th, 1901, and these formed the subject of the second experiment. Up to this time the feeding of these calves was exactly the same as for those in the corresponding batches of the experiment recorded above.

There were four calves in each of the first three lots, and

two in Lot IV. Their average ages were eight and a-quarter weeks, in Lot I., nine and a-half weeks in Lot II., eight and three-quarter weeks in Lot III., and nine and a-half weeks in Lot IV. The preliminary feeding of these calves, and the rations fed up to August 7th, were identical with those in the experiment described above. After August 7th, that is, during the weaning period, the rations were as follows :—

Lot.	Ration.	Ration during 30 days previous to beginning of weaning.	Weaning Period.		
			Aug. 7th to Aug. 14th.	Aug. 14th to Aug. 21st.	Aug. 21st to Sept. 4th.
I.	Whole Milk, quarts	6	3	3	2
	Linseed Cake, oz.	8	8	10	12
II.	Separated Milk, quarts	5	2½	2½	1½
	Whole Milk, quarts	1	½	½	½
	Linseed Cake, oz.	8	8	10	12
III.	Separated Milk, quarts	6	3	3	2
	Cod Liver Oil, oz.	2 to 2½	1¼	1¼	1¼
	Linseed Cake, oz.	8	8	10	12
IV.	Separated Milk, quarts	6	3	3	2
	Indian Meal, oz.	8	4	4	4
	Linseed Cake, oz.	8	8	10	12

From the time weaning was completed on September 4th, and up to October 30th, the calves received linseed cake and Indian meal in the following quantities per head per day :—

	Sept. 4th. to 25th.	Sept. 25th to Oct. 16th.	Oct. 16th to 30th.
Linseed Cake	¾ lb.	¾ lb.	1 lb.
Indian Meal	½ lb.	¾ lb.	1 lb.

From October 30th onwards the calves in this experiment were treated and fed exactly as were those in the first experiment.

The cattle reared on separated milk and cod liver oil yielded the largest increase in live weight, and those reared on whole milk gave higher returns than the two remaining lots.

The gains made during the various periods were as follows :—

Lot.	Rearing Ration.	Average Weight in lb. per Head, June 12th, 1901.	Average Gain in lb. per Head. 1st Summer, June 12th to October 30th.	1st Winter, Oct. 30th 1901, to Apr. 16th 1902.	2nd Summer, Apr. 16th 1902, to Nov. 6th 1902.	2nd Winter, Nov. 6th, 1902, to Feb. 16th 1903.	Average Weight in lb. per Head, Feb. 16th 1903.	Average Total Gain per Head during entire Experiment.
I.	Whole Milk ...	189·0	180·1	142·5	269·7	141·7	923·0	734·0
II.	Separated and Whole Milk...	176·0	152·3	181·8	255·0	96·6	861·7	685·7
III.	Separated Milk and Cod Liver Oil	198·8	161·8	156·5	321·7	119·7	958·5	759·7
IV.	Separated Milk and Indian Meal... ...	184·0	154·0	151·0	309·5	64·0	862·5	678·5

The following comparison of the average value of the animals at 34s. per cwt. live weight, on the weights recorded on February 16th, shows a difference in favour of Lot I. of 18s. 7d. over Lot II., and of 18s. 4d. over Lot IV.; whereas Lot III. has actually a higher value to the extent of 10s. 10d. over Lot I.

Lot.	Ration during first 12 weeks.	Cost of Rearing during first 12 weeks. £ s. d.	Saving effected as compared with Lot I. £ s. d.	Difference in value in favour of Lot I. at close of experiment. s. d.	Net Saving effected as compared with Lot I. £ s. d.
I.	Whole Milk	2 2 3	—	—	—
II.	Separated and Whole Milk	0 16 11	1 5 4	18 7	0 6 9
III.	Separated Milk and Cod Liver Oil ...	0 15 7	1 6 8	—*	1 17 6
IV.	Separated Milk and Indian Meal ...	0 13 2	1 9 1	18 4	0 10 9

* This lot was actually 10s. 10d. per head superior to Lot I.

In this experiment, therefore, the ration of separated milk and cod liver oil gave better returns than either of the other two rations containing separated milk plus another food, whereas in the experiment in which milk was fed to the calves for a longer period, separated milk and cod liver oil gave worse returns than the other two rations. In both experiments the ration of separated milk with Indian meal yielded better results than the mixture of separated and whole milk.

In experiments at the Garforth Experimental Farm (Yorkshire College) it was shown that calves fed on whole milk previous to weaning did not afterwards give such a good return as those reared on separated milk and cod liver oil. This result appears to be confirmed by the above experiments; but until the results of the calf-rearing experiments begun in 1902 and 1903 are available no very decisive conclusions should be drawn from the above series.

This experiment is held to have demonstrated: That calves may be successfully reared on separated milk provided a cream substitute is fed along with it; that calves may be more economically reared on separated milk and a cream substitute than on whole milk; and that the belief so generally expressed when these experiments were started that creamery milk is the cause of the death-rate among calves is entirely unfounded.

Many substances may be used as a cream substitute. In this experiment two only were tested, viz., cod liver oil and maize meal, each in combination with linseed cake, and both were used with satisfactory results. That there are others of equal, if not of greater value, is highly probable, but their value must be determined by further experiments.

In rearing calves, the main points urged upon farmers are—(1) to see that the young calf receives its mother's milk or at least whole milk for not less than four, and preferably six, weeks after birth; (2) to change gradually from whole to separated milk, accompanying the change by the addition of a cream substitute—cod liver oil, or a meal such as Indian meal or oatmeal—which should always contain good linseed or linseed cake, and to endeavour to keep the "calf-flesh" on the animals and not allow them to fall off in condition in autumn and winter.

REFRIGERATION EXPERIMENTS WITH RAILWAY WAGGONS.

Experiments have been conducted in Denmark as to the best system of maintaining railway cars at a low temperature.

Two cars belonging to the State Railways were cooled by means of ice upon a system analogous to that adopted in France, while in a third car ammonia was used as the refrigerating agent.

The latter was an ordinary car, provided with apparatus which permitted the circulation of ammonia gas, set free into pipes arranged in horizontal coils inside the car. At one end of the car, outside, are fixed two iron cylindrical bottles, which contain the necessary liquid ammonia, *i.e.* 80 kilogrammes (about 176 lb.). These communicate at the bottom, by means of a tube provided with a tap and automatic regulating valve, with the coils inside. There are two of these, placed along the end walls inside the car; each consists of two ranges of horizontal tubes occupying the whole upper half of the free space between floor and roof.

The ammonia set free in the first set of pipes is conducted into the second by a tube in the roof; from there into a cylinder placed transversely across the car underneath at the end carrying the iron bottles. This cylinder is connected by a tube with a second receptacle fixed at the outside end of the car, above the cylinder, and provided with a graduated glass tube forming a water level, and with a safety valve to let the air out. Cylinder and receptacle are filled with water, the latter, however, to a slight depth only, and serve to absorb the ammonia gas as it is vapourised; the quantity of gas dissolved, and therefore utilised, is measured by the increase in height of the liquid in the upper vessel.

As the absorption of the ammonia liberates heat, the lower cylinder has to be cooled. For this purpose there is placed in the roof of the car a reservoir of water, which is connected with a horizontal pipe, which runs parallel to and above the cylinder, and is provided with four taps which allow the water to flow drop by drop on the cylinder. This cooling was only

found to be necessary, at least in the experiments (which were conducted during August and September), when the car was stationary for any length of time.

When all the available ammonia is used up, the solution (from which the gas can be re-extracted) must be emptied and replaced by fresh water, and the bottles must also be changed. This latter operation represents one man's work for a quarter of an hour.

The refrigeration of the car depends solely upon the opening and closing of the tap which sets the ammonia free. The absence of ice and melting water also renders the air much drier than in ice waggons. Besides, while the filling of these latter waggons has to be done by opening the cars, through a trap-door in the roof, the replenishing of the ammonia and water is performed entirely outside.

In the experiments conducted, the temperature of the car was about 2—3 degrees Fahr. higher than that obtained by the use of ice, but this was due to the tap not being fully opened. It was found that 1 lb. of ammonia lowered the temperature by the same amount as 3 lb. of ice.

Details are not given concerning the relative economy, from the pecuniary point of view, of the two systems, but in view of the much smaller amount of ammonia required, it seems probable that its use is cheaper than the usual method of employing ice.

The ammonia car always exhibited less variation in temperature than the ice waggons, and seemed hardly affected by changes in the outside air.

[*Extract from Bulletin mensuel de l'Office de Renseignements Agricoles, issued by the French Ministry of Agriculture, May*, 1903.]

THE METHODS OF EXACT FIELD MANURIAL TRIALS.

Dr. P. Wagner has published, in the transactions of the German Agricultural Society, a detailed explanation of the general principles which should be borne in mind in conducting manurial experiments in the field. The rules that he lays

down are of such general application that it has been thought desirable to reproduce a summary of his article. These principles are based largely on his own experience, and much of the following information is accordingly an account of the practice he himself follows in carrying out experiments.

Variations in the yield of differently manured plots of a field can only be accepted as attributable to the action of the manure when it has been definitely ascertained that the only difference in the plots consists in the manures applied. In the conduct of experiments, a field should be chosen which is uniform in all respects. It will be readily understood that absolute uniformity in the conditions is practically unattainable, and an examination should therefore be made to determine how far the field corresponds to such a requirement. Analysis of the soil, although useful, is not sufficient; and a more satisfactory judgment can be formed by exact and repeated observations on the development of the plants. The best method of doing this is to conduct a preliminary trial during one season, no manure, or at least the same manure throughout the field, being used for this purpose; although here again it must be remembered that very different results may be shown in different seasons.

Although it is not possible to eliminate entirely the various irregularities in a field, whether due to the nature of the soil or to the operations performed on it, much can be done to minimise the errors due to this source. One method consists in giving the same manures to several plots and totalling or averaging the results. And here it may be remarked that the reliability of the deductions to be drawn from an experiment is proportional to the accuracy of the standard with which it is compared; hence four or five control plots should be employed, so as to ensure as much accuracy as possible in the standard used for comparison. Another means of rendering the errors less sensible is to use the poorest land, and to manure as heavily as practicable (within limits and, of course, consistently with the question to be elucidated), so as to allow the manures full scope for their action: nitrogenous manures, for instance, will yield little result if the land already contains a considerable supply of that element.

It is often considered that the plots should be as large as

possible, say one-third to two-thirds of an acre ; but this implies a uniform field of two to five acres, and such an area is usually difficult to secure. Dr. Wagner finds that in his own experiments plots of $\frac{1}{100}$ hectare ($\frac{1}{40}$ acre) gave more exact and trustworthy data ; the cost of the experiment is also thus reduced, while the plots are more easily managed, and allow the results to be seen at a glance.

Care should be taken to mark out the size of the plots accurately with the help of pegs, and experimenters should not trust to the eye to get right angles. The plots should preferably be square when this is possible, and similarly manured plots should be as far as possible from each other.

In preparing the manures all salts should be passed through a 4 mm. ($\frac{1}{6}$ inch) mesh sieve, and sampled. The quantity for each plot should then be carefully weighed and mixed with about 15—20% of damp peat mould. The mixture should then be securely fastened up in thick jute bags.

The sowing of the manure on the plots should be entrusted to an experienced man, who should distribute it as uniformly as possible. The manure must not be powdery ; if it is too dry, a little damp earth may be carefully mixed with it ; and it should not be put on in windy or damp weather. After spreading the manure the sacks should be at once thoroughly washed.

The question of how far from the edge of the plot the manuring should stop depends upon circumstances. If the manure is to be spread on the rough furrow and mixed with the soil merely by harrowing in, or when it is merely a case of top dressing with nitrate of soda, it can be put within 10 cm. (four inches) of the edge. But in such cases the experiment must not last more than a year. If it is to last longer on the same ground, or if the field is to be ploughed after the manure is put on, then it must be remembered that the ploughshare moves the soil for a certain distance in front, and throws it also for a certain distance on the side, and Dr. Wagner therefore leaves a corresponding strip all round. In this way are treated all manures which are capable of leaving residues which act in after years, such as potash, phosphoric acid, lime, and organic nitrogen, as well as those which are applied prior to ploughing.

Care must be taken, in ploughing such fields, to use through-

out the operation a plough which throws either to the right or left. Dr. Wagner begins ploughing down one side of the area, goes on on the other side in the opposite direction, throwing the soil outwards, and so on, until there is finally left a furrow down the centre, along the dividing line between two sets of plots. By subsequent ploughing in the reverse direction, beginning along this centre line, this furrow is again filled in, and the manure is thus thrown back, along the edges, into the proper plots.

It has been suggested that the use of longitudinal plots (say fifty by five yards), on which the manure is distributed right up to the edges, but from which a strip of half a yard on each side is not harvested, would yield better results. Dr. Wagner objects to this, however, as it is much easier to distribute the manures uniformly on a square plot, particularly if there be any wind; further, there is a much greater length of boundary—which is a fertile source of error—and there is also the probability that on such an oblong strip there is greater variety of soil, &c., &c. Moreover, as regards the exclusion of a narrow area on the outsides from the crop harvested, it may be observed that the greatest irregularity in manuring generally occurs along the edges, hence the amount of manure actually put on the harvested strip is not that calculated. By taking the whole crop the true amount of manure used is at least accurately known.

The cultivation of the plots should of course be performed with the greatest care, and only experienced workers employed. The work should be so arranged that the whole of the plots that make up an experiment are treated uninterruptedly, preferably in a single day. No seed should be used which has not been previously tested. Hoeing and earthing should be done by hand, and, of course, no machinery should be used in harvesting. Weeds should be destroyed without the aid of sulphate of iron or other corrosive, and the plots must be kept as clean as possible.

Nitrate of soda should not be applied as a top dressing in wet weather or when dew is on the plants, which must be quite dry. The opportunity may be taken, in top dressing, to remedy any irregularities by giving a little more where the plant is thinner.

In harvesting grain crops the scythe should be used, and the corn bound into sheaves at once and weighed upon the ground. Dr. Wagner's method is to take during reaping some half-dozen samples (ears and straw, as cut), weighing twelve or fifteen pounds altogether, from various parts of the plot, and tie them up in a sack, which is numbered according to the plot from which it comes. The sheaves are then left to the owner of the field, and the only point to be carefully observed is that they are immediately removed (if the experiment is to be continued on the field). The yield of corn per acre and the proportion of grain to straw can be calculated from the samples. Dr. Wagner finds this method preferable to leaving the corn for some days upon the field before being weighed, as serious errors may result from the grain falling out or weather conditions, sources of error which are all the greater as the different manuring will have induced different degrees of ripeness. It is preferable also to carting off and threshing the whole crop from a plot, since much grain is lost in the loading, transport, unloading, &c.

The sacks containing the samples are hung up (so that mice may not get at them) in a light, airy room, and after eight days or so are brought out on to trestles in the open air and the contents threshed by a hand machine. The straw is then chopped up, the grain cleaned, and the husks mixed with the chopped straw. Of this a sample of about thirty to forty grammes is taken in order to determine the moisture content; another sample of about two pounds is also taken for further examination and chemical analysis. Two hundred grammes of the grain are taken for the same purpose.

In the case of roots, as soon as they are pulled up from the ground the leaves are cut off, and both they and the roots are at once weighed. A sample of thirty to forty pounds of roots and about sixteen to eighteen pounds of leaves are taken from each plot. Only normal roots are taken for this purpose, very large or very small ones being excluded. The samples are put up in sacks, and immediately carried to the experimental station; if this cannot be done the same day they are laid down separately (so as not to heat each other), and removed the next morning. The sample leaves are dealt with as soon as possible: each is weighed, chopped, and an average sample of exactly one kilo-

gramme taken to determine the moisture content. The roots are also at once washed, dried, weighed, and split into four quarters longitudinally. One quarter of each root is then sliced by a suitable machine, and an average sample of one kilogramme taken.

Potatoes are treated in the same way, but the tubers are allowed to lie a few hours on the ground in order that too much soil may not remain clinging to them. The haulm, however, is not collected, as its weight and examination present little interest, but is removed from the field as soon as possible.

Clover and grass is weighed green on the field, samples of about fifteen pounds taken from each plot, and treated in the same way as the leaves of the root crop. It is not advisable to let the crop dry on the ground, since loss of leafage and other accidents may lead to untrustworthy results.

GROUND BEETLES IN MANGOLDS.

Specimens of beetles, which were found to be injuring mangolds, were recently forwarded to the Board of Agriculture, and have been identified as *Pterostichus* (or *Steropus*) *mandidus.* These ground beetles are generally common, and were at one time thought to be carnivorous only, and therefore beneficial. (Curtis records this species as attacking and eating wireworms.) Although the majority are so, it is now known, however, that certain species are very destructive. Three at least besides that mentioned do a great deal of harm to strawberries ; and *Pterostichus mandidus,* besides attacking mangolds and strawberries, is also found eating swedes and kohl-rabi.

Miss Ormerod states that these beetles have been caught early in the morning in the act of eating mangolds. The injury was just at the ground level, sometimes all round what may be termed the shoulders of the root, sometimes only on one side or in patches, the damage extending very little below the ground line, and chiefly above it. The beetles did not eat

the leaves, and the damage was noticed as being done in the very early morning or, in fact, almost in the night. The mangold died of the injury as the sun came on it.*

When pieces only are eaten out of the root the plant never properly develops, but deformed and stunted mangolds result.

Like most *Carabidæ*, this pest works almost entirely at night and hides away during the day. One favourite hiding place is under stones. Several attacks have been noticed in fields where flints are abundant.

As far as is known the female lays her eggs either in the earth or under stones. The larvæ hatch from the eggs in eight days and appear to be purely carnivorous. They are dark-brown with large head and jaws and six-jointed-legs in front; when mature they are about two-thirds of an inch long. The end of the body has two long bristly processes. When mature they pupate in the ground and remain as pupæ during the winter months.

After an attack of this pest the land should be deeply ploughed and mangolds should not be grown in neighbouring fields when it is possible to avoid doing so. The beetles have no wings, so cannot travel far; and although carnivorous their increase would probably thus be checked, since these roots now undoubtedly form one of their favourite foods. When young plants are attacked frequent side and horse-hoeing would disturb them and so do some good. The best plan is possibly to trap the beetles in the fields; this might be done by putting down sheep skins here and there; the beetles would shelter beneath them during the day and could then be collected. Sacking or other material should also answer the purpose. No dressings are likely to affect this pest.

THE SAW-TOOTHED GRAIN WEEVIL.

(*Silvanus surinamensis*. Linn.)

This small beetle is one of the commonest pests in grain, groceries, meal, and almost all edible stores. Although it is

* Ninth Report of Observations on Injurious Insects during 1885, p. 51.

generally omnivorous it has a strong liking for cereals and farinaceous substances. It is recorded as attacking, amongst other things, red pepper, mace, yeast, tobacco, and preserved fruits. Bags in which meal, flour, &c. are kept may be perforated by it, and in one instance this beetle has been recorded as annoying people at night by nipping them when in bed, Both larva and adult do damage. They occur all the year round, but are most abundant in warm weather.

The beetle is about one-tenth of an inch long, and of a rich deep brown colour. It is rather flat, and can easily be recognised by the curiously notched thorax, there being six distinct spines on each side and two more or less prominent grooves above in the middle. The female lays her eggs in the meal, &c., and from them come very active little larvæ, nearly white in colour and rather flat. Each segment of the grub has a darker area in the middle. When mature the larva reaches about one-fifth of an inch, and then turns into the pupa where it has been feeding; sometimes a cocoon is formed of coarse meal and grain; at other times the pupa is naked, as usually occurs when this pest invades and lives in flour and meal.

It would appear that the winter is passed in this country in the mature condition. The life cycle varies in this country from five to ten weeks. In America it is recorded as passing through all its stages in twenty-four days. The variation in time taken to mature depends upon temperature and amount of food supply.

It may be treated in the same way as the Corn Weevil, described in Vol. VIII., p. 358, of this *Journal*, viz., if the store house or barn is fairly airtight, by fumigating with bisulphide of carbon. Meal rooms should be well cleaned out and all refuse burned. Thoroughly scrubbing down with hot soft soap and water would probably be effective.

MILLIPEDES AND CENTIPEDES.

FIG. 1.

FIG. 2.

FIG. 3.

Figs. 1 and 2, Millipedes (1 *Julus pulchellus*, 2 *Polydesmus complanatus*); Fig. 3, Centipede (*Geophilus subterraneus*).

Millipedes (Figs. 1 and 2) and centipedes (Fig. 3) belong to a group of the animal kingdom known as the *Myriapoda*. These animals are recognised by having legs on every ring or segment of the body. In the case of the millipedes there are two pairs of legs to each segment; in the centipedes, one pair only. It is important to notice these differences, as the millipedes are injurious, and the centipedes are beneficial.

They are found in all manner of places, both in the field and in the garden, and are especially attracted by decaying vegetation, such as heaps of leaf mould, rotting stalks, &c. They are also found crawling about under the bark of trees and in the soil. The difference in structure is also accompanied by a difference in habits; centipedes are very active and are carnivorous, whereas millipedes are mostly herbivorous, and live upon sound and decaying vegetable matter. The millipedes have the mouth formed for chewing, there being powerful biting mandibles with which to devour the roots of plants. Centipedes are provided with poison claws. The bite of some centipedes in the tropics is very poisonous to man, but none are

so in this country. Millipedes are often known as "false wireworms," but they can easily be told from the true wireworm (*see* Leaflet 10) by the great number of legs.

The most injurious millipedes belong to the families *Julidæ* and *Polydesmidæ*. The latter are the *flattened* snake millipedes, the injurious species being shown in Fig. 2. The most troublesome species is *Julus pulchellus* (Fig. 1). This is nearly half an inch long, slender, about the thickness of a fair-sized pin, pale yellowish-pink in colour, with a double row of purple spots on it. *Julus terrestris*, another common species, is black and has a pointed tail. These *Julidæ* feed upon all manner of roots. The smaller *Julus pulchellus* also eats into potatoes and lilies, often hollowing them out completely; the larger species, according to some observers, also feed upon snails, slugs, and some insects. The common species of *flattened* millipedes, *Polydesmus complanatus* (Fig. 2), is of a pale purplish-white to dull rosy tint, and is nearly an inch long, with the sides notched.

The female millipede (*Julus terrestris*) deposits her eggs from May to July in a nest made of pieces of earth fastened together with saliva; this nest is round in form and has a small hole at the top through which the eggs are dropped. The eggs vary in number from 60 to 100. The hole is then stopped up and the eggs mature in from 10 to 14 days. The young millipedes have only three pairs of legs, the others appear in groups by degrees. Growth in a millipede takes place by lengthening at the posterior end, the growth evidently taking place between the penultimate and last segments. Miss Ormerod states that millipedes lay their eggs from December to May, but as this does not agree with Sinclair's observations it probably applies to some other species of millipede.

Centipedes, or *Chilopoda*, are beneficial, the food being composed of snails, slugs, and ground insects. Three of the commonest genera are *Lithobius*, *Geophilus* (Fig. 3), and *Scolopendra*. The eggs of *Lithobius* are laid from June to August; they are about the size of a No. 5 shot, spherical in form, and covered with a sticky slime. The female after laying an egg rolls it about in the earth until it is all covered with soil and resembles a grain of earth. A small number only are laid by each female; and the males frequently devour the eggs before

the female coats them with earth. In the other genera the number probably varies to some extent. *Geophilus* is said to lay its eggs in an earthen cell; *Scolopendra* to bring forth living young.

These pests are frequently distributed with leaf mould, which should, therefore, be examined before being used, and if found to contain them should be mixed with lime. Their numbers in the field may also be lessened by broad-casting lime over the surface and working it into the soil. Soot and water, in the proportion of a handful of soot to half a gallon of water, is found to drive them away from the roots of garden plants for a time. They may also be trapped in numbers by placing pieces of mangolds scooped out just under the ground near the plants they are attacking; they swarm over the baits and may then be collected and destroyed.

Another certain way of killing them on small areas is by injecting bisulphide of carbon into the soil. They may also be trapped by soaking decaying cabbage leaves or decaying roots in Paris green and placing them about in gardens; the millipedes feed upon them and thus get poisoned.*

ANALYSIS OF SOUR MILK.

The fact that samples of milk referred to the Government Laboratory under the provisions of the Sale of Food and Drugs Acts are invariably sour when received, has occasionally given rise to inquiries, by magistrates' clerks and others concerned with the working of the Acts, as to the practicability of making a satisfactory analysis of sour milk, with a view of substantiating or disproving an allegation that the milk has been mixed with water, or that fat has been abstracted from it.

The Board of Agriculture have therefore issued a circular to

* Copies of this article in leaflet form may be obtained post free and free of charge upon application to the Secretary, Board of Agriculture, 4, Whitehall Place, London, S.W.

local authorities in Great Britain in which they state that except in a limited number of exceptional cases to be hereafter referred to, there is no practical difficulty in accurately inferring the composition of the milk when fresh from the analysis of the milk when sour.

The change which takes place in a sample of milk kept from contact with air, as in a bottle nearly full of the sample, and fitted with a good sound cork sealed with wax, is, as a rule, comparatively slight. The causes and nature of this change have been carefully studied by many observers, and they have been found to be perfectly definite in character. Without going into details concerning the fermentative changes to which milk is liable, it may be stated that the changes which affect the analysis, and, therefore, the inference to be drawn from the results, are concerned with the non-fatty solids only, and more particularly with the milk-sugar. The milk-sugar gives rise, either proximately or remotely, to a variety of products, the most important of which are lactic acid, ethyl alcohol, and acetic acid; but it can be shown that the only quantitative determinations which need be made in order to determine the loss in the non-fatty matter by keeping are the proportion of alcohol, reckoned as proof-spirit, and the amount of free volatile acid, together with the ammonia derived from the alteration of the casein, or proteid substance, in the milk. The slight alterations in weight consequent on the hydrolysis and conversion of lactose into lactic acid, and the formation of certain so-called bye-products of alcoholic fermentation, are partly positive and partly negative in direction, but their joint effect is too small to have any appreciable influence on the result.

The entire correction, which, of course, is always additive, in the case of a properly-preserved sample from three to six weeks old, is fairly constant, and may be said to range from 0·2 to 0·3 per cent. In a few cases it has been found to be as low as 0·1 per cent., and in very exceptional cases, as in badly-secured samples, or in bottles only partially filled, it has risen to 0·7 or 0·8 per cent.

If the fermentation has passed into the butyric acid stage, the amount of free acid is greatly increased, and owing to the separated casein it is sometimes impossible to get the sample into a

proper and uniform condition for analysis. In such cases the Government Laboratory declines to proceed with the examination. Such a result, however, practically never happens in the case of samples which have been properly taken and kept by the inspectors pending the appeal to the Government Laboratory.

The details of the methods of analysis adopted in the Government Laboratory were fully inquired into by the Committee which preceded the issue of the Sale of Milk Regulations in 1901, and are given in Appendix XXIX. to the Minutes of Evidence taken before the Departmental Committee on Milk and Cream Regulations [Cd. 484].

The following tables [Cd. 484, Appendix XXIX.] give the results of the analysis of a series of milks analysed in the fresh state and after the lapse of several weeks. The examination was carried beyond the time at which a milk would be referred to the Government Laboratory under the Food and Drugs Acts, but it will be seen that the changes can be accurately followed and allowed for. The comparison of the corrected non-fatty solids with the solids of the fresh milk shows that the variations are not greater than may occur in duplicate determinations of the constituents of a fresh milk :—

WHOLE MILKS.

No.	Fresh Milk.		Kept Milk.			Total Loss.	
	Non-fatty solids.	Fat.	Time in days.	Non-fatty solids.	Fat.	Calculated.	Actual.
1	8·97	4·08	21	8·71	4·02	·20	·26
1A	8·97	4·08	27	8·74	3·97	·21	·23
1B	8·97	4·08	50	8·61	4·00	·34	·36
1C	8·97	4·08	85	8·49	4·09	·49	·48
2	8·99	3·17	27	8·60	3·16	·35	·39
3	9·12	4·16	42	8·82	4·18	·33	·30
3A	9·12	4·16	102	8·88	4·18	·25	·24
4	9·02	4·72	41	8·56	4·65	·58	·46
5	9·02	3·28	52	8·76	3·25	·20	·26
5A	9·02	3·28	79	8·53	3·34	·49	·49
5B	9·02	3·28	93	8·35	3·27	·61	·67
6	9·13	4·49	57	8·88	4·35	·23	·25
8	9·52	4·06	74	9·25	3·92	·35	·27
9	9·27	4·07	77	8·91	4·06	·32	·36
10	9·11	4·19	91	8·24	4·14	·76	·87
11	9·34	4·07	91	9·01	4·01	·41	·33
12	8·42	3·70	91	8·14	3·69	·26	·28
13	8·83	5·32	91	8·56	5·20	·31	·27
14	9·20	3·98	91	8·80	3·83	·39	·40

MILKS TO WHICH APPROXIMATELY 10 PER CENT. OF WATER HAS BEEN ADDED.

No.	Fresh Milk.		Kept Milk.			Total Loss.	
	Non-fatty solids.	Fat.	Time in days.	Non-fatty solids.	Fat.	Calculated.	Actual.
1	8·14	3·44	14	7·96	3·41	·27	·18
2	8·14	3·44	30	7·81	3·40	·42	·33
3	8·24	2·79	38	7·88	2·78	·33	·36
4	8·24	2·79	38	7·73	2·76	·50	·51

SEPARATED MILKS.

No.	*Fresh Milk.*		*Kept Milk.*			*Total Loss.*	
	Total solids.	Fat.	Time in days.	Total solids.	Fat.	Calculated.	Actual.
1	9·66	·14	27	9·25	Not determined.	·22	·41
1A	9·66	·14	36	9·34		·13	·32
1B	9·66	·14	65	9·35		·26	·31
2	8·91	·09	28	8·62		·28	·29
2B	8·91	·09	37	8·60		·20	·31
3	8·61	·13	30	8·33		·24	·28
3A	8·61	·13	37	8·29		·28	·32
3B	8·61	·13	91	7·93		·58	·68

SEPARATED MILKS TO WHICH APPROXIMATELY 10 PER CENT. OF WATER WAS ADDED.

No.	Fresh Milk.		Kept Milk.			Total Loss.	
	Total solids.	Fat.	Time in days.	Total solids.	Fat.	Calculated.	Actual.
1	8·18	—	21	7·86	Not determined.	·24	·32
1A	8·18	—	387	6·71		1·50	1·47
1B	8·18	—	388	6·64		1·56	1·54
1C	8·18	—	401	6·71		1·50	1·47
2	7·67	—	22	7·22		·33	·45
2A	7·67	—	387	6·24		1·49	1·43
3	7·76	—	73	7·11		·55	·65
4	7·80	—	185	6·22		1·59	1·58
4A	7·80	—	188	6·19		1·69	1·61

COLLECTION AND RETENTION OF SAMPLES OF BUTTER.

The Board of Agriculture issued on July 13th last a circular to local authorities under the Sale of Food and Drugs Acts,

1875 to 1899, in Great Britain with regard to the collection and retention of samples of butter.

In this circular the attention of local authorities is drawn to the fact that samples of butter, alleged to contain water in excess of the proportion indicated by the Board in their "Sale of Butter Regulations, 1902," are frequently received at the Government Laboratory after the lapse of one or two months from the time that the samples were taken, and that subsequently to the date of purchase they have been kept by the inspector in the paper in which they were originally bought. Under these circumstances it is quite impossible for the Government Laboratory to obtain upon analysis figures representing the amount of water present at the time of purchase, and discrepancies between their results and those of the analysts on which the charge is raised are inevitable.

The Board point out that it is very desirable that, so far as may be found practicable, there should be uniformity of procedure in collecting and retaining samples of butter taken under the Sale of Food and Drugs Acts, and the following recommendations have been drawn up for the guidance of the local officials employed in this work :—

1. The quantity to be purchased should not be less than one pound, except that it may be expedient to purchase only half a pound in cases where there is reason to believe that the object of the purchase would be defeated if a greater quantity were demanded.

2. The division of the sample into three parts should be made as equally as possible, so that the portion reserved by the purchaser may be not less than one-third of the whole. It is desirable that each portion should consist of one piece only.

3. The portions should *not* be wrapped in paper, but should be placed, without pressure, in dry and clean screw-capped bottles in such manner that the water present may be retained in the butter.

4. The screw-capped bottle should be provided with a cork-lined metallic lid. The mouth should be as nearly as possible the full width of the bottle, and the cork lining of the lid should be firmly screwed down against the edge of the bottle.

5. The bottle, labelled with the necessary particulars, should be enclosed in an envelope of stout paper, which should be secured with the official seal.

6. The reserved portion should be kept in a cool dark place pending its production in Court in the event of proceedings being taken, and if directed by the Court to be referred to the Commissioners of Inland Revenue it should be carefully packed in order to ensure its safe transmission to the Government Laboratory.

YEW POISONING.

Considerable uncertainty exists as to the nature of the poisonous constituent of the leaves of the yew, and the Board of Agriculture accordingly made arrangements with the Principal Chemist of the Government Laboratory, who undertook to carry out experiments to determine its nature more exactly. The results of this enquiry have been published in the *Transactions of the Chemical Society*, and the following particulars, which are of more immediate interest to stock owners, are summarised from that source.*

That, under certain circumstances, the leaves and fruit of the yew tree may be poisonous has long been known. Many instances, however, have been recorded in which no fatal result has followed from eating the leaves, and hence it has been alleged that the leaves vary in toxic character with the period of the year, or are different in different years, and that certain animals are immune to the poison. It has also been alleged that the leaves from the male tree only are poisonous, leaves from the female tree being innocuous. It has been stated by some that only the young green shoots contain the poison ; by others, that the fresh green leaves have no fatal effect on cattle, but are poisonous when dry. It appears that the lower branches of yew trees in parks and grounds are constantly cropped by cattle without any ill effects. As regards the fruit, it is generally believed that the outer fleshy pulp is not poisonous, whilst the true seed contains a poison and is very dangerous.

* *Taxine.*—By T. E. Thorpe, C.B., F.R.S., and George Stubbs, *Trans. Chemical Society*, 1902, vol. 81, p. 874.

There is little doubt that in the numerous recorded instances of fatal effects from eating yew leaves there exists sufficient evidence to show that, under some circumstances, the yew tree contains an active poisonous principle, but the conclusions hitherto obtainable are very indefinite. It is possible, of course, that the poisonous principle does not exist in the leaves, but is the product of the action of the juices of the stomach or of the fermentation during the drying of the leaves.

Various chemists have been successful in separating from yew leaves an alkaloid substance to which the name taxine has been given; but the particulars given concerning it by different experimentalists vary considerably, and it was with the object of learning more as to the constitution of this substance that investigations were undertaken at the Government Laboratory.

Considerable difficulties were at first encountered in obtaining a sufficient quantity of the alkaloid. By various methods, from 0·07 to 0·12 per cent. (calculated on the green leaves) of taxine was obtained in preliminary work from female yew leaves. Subsequent treatment of male leaves gave 0·18 per cent. Although this amount is greater than that obtained from the female leaves in the preliminary examination, the inference cannot be drawn that the actual quantity present in the leaves was greater: the substance undergoes change so very easily that the quantities first yielded are thought to be too low. There appeared to be no difference in the quantity yielded by fresh and by air-dried leaves.

The taxine, after drying in a vacuum, presented the appearance of very fine, glittering particles, extremely light, with no smell and a very bitter taste.

The physiological action of taxine was examined in 1876 in Germany, and it was stated that, when administered to frogs, rabbits, cats, and dogs it depresses the action of the heart and interferes with the respiratory functions, death ensuing from suffocation in a short time. It has been asserted, however, that taxine has no action on guinea-pigs, and further experiments are required to establish definitely whether the alkaloid is actually poisonous, and if so, how it acts, and whether, as alleged, certain animals are immune to it.

RINGWORM IN CATTLE.

Ringworm is a disease which may attack any of our domesticated animals, but is most frequently seen on cattle. It is also transmissible to human beings.

It evinces a decided preference for young animals, such as calves and yearlings, and for stock that are in poor condition.

The disease is due to the attack of a microscopic fungus (*Trichophyton tonsurans*) which establishes itself at the base of the hair, and this, in consequence, becomes brittle and breaks off. The presence of the fungus also causes the epidermis of the skin to become thickened and wrinkled. In this way bare, gray, scaley patches, two inches or more in diameter, appear upon the animal, especially on its head and neck, though also on other parts of its body.

As has been indicated, animals in low condition are most apt to be attacked, so that a preventive measure is to keep young stock in good condition.

The disease is not difficult to cure, the substances employed for this purpose being very varied. Many of them depend for their effectiveness on so smearing the affected patches that the fungus shall be smothered from want of air. In order to enable any substance employed to get thoroughly into contact with the disease, the part attacked should be well washed with soft soap, or, better still, with a solution of washing soda. Then the patch may be dressed with one or other of the following:—

(*a*) Train oil 5 parts, sulphur 1 part.
(*b*) Lard 5 parts, sulphur 1 part.
(*c*) Lard 5 parts, iodine 1 part.
(*d*) Lard 5 parts, oleate of copper 1 part.
(*e*) Soft soap 5 parts, sulphur 1 part.
(*f*) Sulphuric acid 1 fluid drachm, glycerine 3 fluid drachms.

Other substances employed, more or less successfully, are paraffin oil, lime made into a paste, and mercurial ointment. The last-named, however, being highly poisonous, should only be used under the advice of a veterinary practitioner.

The disease is very contagious, and will linger on the woodwork of stalls, rubbing posts, &c., for many months. These should, therefore, be cleansed by a weak solution of carbolic acid, *or by whitewash, or some other disinfecting agent.*

REDUCED RAILWAY RATES FOR CARRIAGE OF RAMS.

In consequence of representations addressed to them by the National Sheepbreeders' Association with regard to the heavy charges made by railway companies for the carriage of rams by passenger train, the Board of Agriculture requested the Board of Trade to call the attention of the railway companies to the disproportion between these charges and the rates for ewes and wethers similarly conveyed, and to suggest that the matter was one which required revision.

As a result of the negotiations with the railway companies, the Board of Agriculture are pleased to be able to announce that the railway superintendents in conference have agreed that rams sent singly, loose, or in crates, by passenger trains, shall now be charged as follows:—

For the first 50 miles ...	1½d. per mile (minimum, 2s. 6d.).
For the next 50 miles ...	1d. per mile.
For the remainder of distance	½d. per mile.

Fractions of a penny to be reckoned as a penny in ultimate calculation.

These reduced rates came into operation on September 1st, 1903.

"FROST-PROOF" POTATOES.

The Board of Agriculture have received applications for information concerning a "frost-proof" potato recently introduced into France. The Director of the Royal Gardens, Kew, has informed the Board that the plant in question is *Solanum Commersonii*, Dun., a native of Uruguay, Paraguay, and Entre

Rios (Argentina), and that it was introduced into France about 1896 or 1897.

The tubers are said to be quite hardy, having withstood at Moulins temperatures of 5 degrees and −2 degrees Fahr. They do well in compact, moderately moist soil, and their size—originally that of a hazel nut—has been brought up to that of an ordinary potato. They are not yet, however, *eatable*, as they contain too much of a bitter principle (solanine). An amelioration in this respect has, it is stated, already been observed, and it may be possible in the future to get rid of the solanine entirely. Meanwhile, crossing *Solanum Commersonii* with the common potato seems to be an experiment worth trying.

Further information on this subject is contained in articles by E. Heckel (*Annal. Facult. Sci., Marseille*, VII., 1898, pp. 101-115), E. Olivier (*Bull. Soc. Nat. Acclimat., France*, 1902, p. 140), and L. Tillier (*Rev. Hort.*, 1902, pp. 338-40).

REGULATIONS FOR MORNING ADMISSION TO THE ROYAL BOTANIC GARDENS, KEW.

1. Persons desiring access to the Royal Botanic Gardens for the *bonâ fide* purpose of drawing, sketching, photography, or *special* study, can obtain a card of admission by applying by post to the Director, stating the object for which admission is desired. The privilege is strictly personal to the holder of the card, and it is not transferable.

2. A card of admission cannot be issued to admit a class or a party collectively.

3. Holders of cards who desire to enter the Gardens before public hours must do so by the gate adjoining the Curator's Office, where they will sign the Register before entering. During public hours they may enter by any of the public gates on showing the card of admission to the gatekeeper.

4. Admission may be obtained after 6 a.m. from April to September, and after 8 a.m. from October to March.

5. The privilege is not, however, available on Sundays, Christmas Day, Good Friday, or Bank Holidays.

6. Except when the Gardens are opened to the public at 10 a.m., holders of cards are admitted into the plant-houses until noon, provided that they do not in any way interfere with the workmen in the performance of their duties. When the Gardens are opened at 10 a.m., the privilege of ticket-holders is restricted to the open air. At no time are persons permitted to sketch or photograph in the houses during public hours.

7. It is particularly desired that visitors will abstain from handling specimens without permission from the person in charge of them.

8. The Staff of the Royal Botanic Gardens accept no responsibility as regards the custody of drawing, photographic, or other apparatus.

ANALYSES OF IMPORTED AGRICULTURAL PRODUCE.

The annual report of the principal chemist of the Government Laboratory for the year ending March 31st, 1903, states that 2,443 samples were analysed during the year on behalf of the Board of Agriculture. This total included 1,959 analyses of imported butter, 234 of imported cheese, 29 of imported fresh and sterilised milk, 135 of imported condensed milk, and 32 of imported cream, besides one analysis of a feeding stuff, two of fertilisers and five of miscellaneous articles. None of the samples of imported butter were found to be adulterated, but 656 contained boric preservative, and 373 were artificially coloured.

The samples of cheese examined did not include any of margarine cheese. The amount of fat, however, in several instances was very small, falling as low as 0·6 per cent. in one sample and 0·8 per cent. in another.

Of the 135 samples of condensed milk taken, one, which came from Holland, was found to be machine-skimmed, although not so labelled.

One sample of sterilised milk from Italy and two from Holland were reported as being deficient in fat, while one sample of French sterilised milk was reported as containing added water.

SUMMARY OF PROGRESS OF THE GEOLOGICAL SURVEY OF THE UNITED KINGDOM FOR 1902.

This work contains a record of the field work in England and Wales, Scotland and Ireland, and of the chemical, petrological, and palaeontological work carried out in connection with it.

Progress has been made with the re-survey of the southern part of the Derbyshire and Nottinghamshire coal-field, of the South Wales coal-field as far as Llanelly, and of the Edinburgh coal-field. In Cornwall special attention has been given to the mining work, to the sub-division of the killas, and to the granite near St. Agnes. A re-survey of portions of the London area has been made in order to separate the gravels and brick earths of the Thames Valley, with the view of publishing a colour-printed one-inch map of the area.

In Scotland the Highland schists, and problems connected with them, the Torridon sandstone, the Easdale slates, the quartzite of Jura and Islay, the rocks of the islands of Eigg and Rum are dealt with. In Ireland the drifts have been surveyed in the Belfast region, and these are fully described.

Some of the matters are dealt with more in detail in the appendix, such as the stanniferous vein-stones of Cornwall, the classification of Devonian and carboniferous rocks, the plants of the Canonbie coal-field, natural gas at Heathfield, railway-cutting at Chipping Sodbury, &c. There is also a list of some types of figured specimens of Jurassic Gasteropoda in the Museum of Practical Geology.

The price of this volume is one shilling, and copies may be obtained from any agent for the sale of Ordnance Survey maps, or directly, or through any bookseller, from the Ordnance Survey Office, Southampton.

DEMAND FOR PRESERVED VEGETABLES.

In connection with the revised scale of Victualling which will come into force in His Majesty's Navy on the 1st October, the Board of Admiralty direct attention to the fact that the decision

to include preserved vegetables in the scale has already rendered large purchases of these goods necessary, and that it is anticipated that supplies of similar magnitude will be required annually for the future. The Board point out that of eighteen firms noted for the supply of these articles only one possesses a factory in the United Kingdom, the remainder being Canadian, French, German, or Dutch; and they state the following as being among the reasons which have been adduced for the comparative failure to establish an industry in preserving vegetables in this country: (*a*) The great demand for fresh vegetables and consequent high prices; (*b*) the excess of moisture in vegetables grown in this country, rendering them unsuitable for drying; and (*c*) the high rate of wages prevailing in the United Kingdom.

The following are the conditions of contract for recent supplies:—

1. *Quality Specification, &c.*—The vegetables to be supplied under the contract shall be answerable in every respect to the following Specification, and shall be in all respects equal to the samples accepted.

The vegetables shall be preserved by drying, desiccating, or evaporating, and shall be equal in all respects to the approved samples.

They shall be of the latest growth and best quality, carefully cleaned and well preserved, shall be free from adulteration and from all chemical preservatives, colouring matter, or metallic impurities.

They shall not contain more than 12 per cent. of moisture.

The vegetables consist of the following descriptions:—Potato in slices; haricot beans; beans, shredded or whole; onions; carrots, shredded; cabbage; spinach; mixed vegetables.

The five latter descriptions shall be compressed. The mixed vegetables shall consist of:—Potato, 50 per. cent., onion, 25 per cent., carrot, 25 per cent., well blended.

They shall be packed in 1 lb., 2 lb., 5 lb., and 10 lb. tins hermetically sealed.

The tins shall be painted or lacquered so that the paint or lacquer will not easily rub off or chip.

The tins shall be packed in strong export cases, each contain-

ing 25 lb. or 50 lb. net, in the following proportions, viz. 25 lb. case consisting of one 10 lb., one 5 lb., four 2 lb., and two 1 lb. tins; 50 lb. case consisting of two 10 lb., two 5 lb., eight 2 lb., and four 1 lb. tins. Each tin shall bear a label giving the quantity and description of the contents, and clear instructions as to the best method of cooking.

The date and year of preparation to be marked on the side of each case, together with the name of the contractors. No other marks or labels will be allowed. This does not exclude any private mark for contractors' own guidance.

2. *Warranty.*—The goods shall be warranted to keep fit for use and in good condition on board ship, and in any climate, for a period of two years from the date of delivery into store, and all condemned within that period shall be replaced by the contractors free of charge.

The following shows the quantities of preserved vegetables procured by recent tenders:—

			lb.
	Potato in slices	In 25 lb. cases	12,350
		,, 50 ,, ...	37,150
	Beans, shredded or whole ...	,, 25 ,, ...	8,250
		,, 50 ,, ...	24,750
	Haricot beans	,, 25 ,, ...	2,050
		,, 50 ,, ...	6,200
	Mixed vegetables	,, 25 ,, ...	4,100
		,, 50 ,, ...	12,400
Compressed.	Cabbage, dark green curly ...	,, 25 ,, ...	9,100
		,, 50 ,, ...	27,400
	Carrots, shredded	,, 25 ,, ...	4,100
		,, 50 ,, ...	12,400
	Spinach	,, 25 ,, ...	9,000
		,, 50 ,, ...	26,900
	Onions	,, 25 ,, ...	2,050
		,, 50 ,, ...	6,200

THE CO-OPERATIVE BACON-CURING INDUSTRY OF DENMARK.

The Department of Agriculture and Technical Instruction for Ireland recently sent a deputation to Denmark to investigate the bacon-curing industry in that country, and to endeavour to ascertain the methods which had been followed by the Danish farmers and merchants in successfully establishing co-operative bacon factories. The following information is extracted from

the report of the deputation, which has been issued in pamphlet form.*

The total number of bacon factories in Denmark is at present fifty-one, consisting of twenty-seven co-operative bacon factories, with 64,000 members, and one in course of erection, and twenty-four private factories. The number of pigs killed at these co-operative factories is said to be over 777,000 annually. In some cases, in conjunction with the co-operative factories—in fact, in eleven cases out of the twenty-seven—there are slaughter-houses for animals other than swine, attached, and in the year 1902 about 12,000 other animals were slaughtered at the bacon factories.

The Kalundborg co-operative factory was the first one visited by the deputation in Denmark, and may be taken as typical of the organisation of these establishments. It has a membership of 1,220, and deals with 16,000 pigs per annum.

The organisation of the Kalundborg Society began with the holding of a series of meetings in all the parishes within a radius of about ten English miles. The project was fully discussed, and experts from the Royal Danish Agricultural Society were in constant attendance to explain technical points in connection with the industry, and to give instruction in the breeding and rearing of pigs. The farmers were invited to bind themselves to their society in a two-fold form of guarantee, namely—(1) that they should supply the whole of the pigs raised on their farms to the factory for a period of eight years, with certain exceptions clearly specified in the rules ; and (2) that they should become guarantors for the loan required to erect and equip the factory, and to provide working capital in the proportion allocated by the organising committee, and based upon the size of their farms. At first there was some difficulty in convincing farmers that this guarantee was perfectly safe, and consequently, at the outset, the membership was small. As soon, however, as the functions of the society came to be understood, almost every farmer was but too willing to pledge his credit in its interest and support it by every means in his power.

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* *Department of Agriculture (Ireland) : Bulletin 5, Miscellaneous Series.*

The largest number of pigs are delivered to the factory in the summer, and the manager, in order to find suitable employment for his workmen during the rather slack months of the spring, has induced his committee to add the packing and preservation of eggs to their business. The farms in the Kalundborg district keep on an average from twelve to fifteen cows, and, generally speaking, as many pigs are supplied to the factory as there are milch cows kept on the farm. The greatest distance from which pigs are supplied is about 16 miles, and from districts convenient to the railway line the animals are sent in by rail. The society has provided itself with railway trucks for its dead meat traffic. The buildings and machinery of the factory cost in round figures £6,000, and a further overdraft of £2,000 was necessary as working capital for the purposes of the society's business. The society employs twenty workmen, only one of whom may be described as a skilled operative, namely, the foreman butcher, whose wages are 2,000 kroner, or £112, per annum. The other hands are paid at the rate of from 20 kroner (22s.) weekly, or less. In this factory, as in all others, a live-weight scale is provided, so that farmers may satisfy themselves, if they so desire, of the actual live weight of their pigs at the moment of delivery, but such is the confidence of the members that the live weight scale is very seldom used. In most Danish co-operative bacon factories, the loss in killing, or the reduction from live to dead weight, averages 25 per cent., while the difference between dead weight and cured weight is usually 25 Danish lb., or 28 lb. English. Pigs are killed twice weekly, namely, Tuesdays and Fridays.

A description is given in the report of the various departments of a bacon factory, and the processes employed from the reception of the pig to the despatch of the train to market are described.

Every part of the animal is converted into some form of saleable commodity—blood, bristles, bones, and entrails being all utilised and afterwards disposed of as by-products of the business.

The following particulars of expenses (wages and insurances) at Kalundborg are quoted as a fair example of those prevailing

in the greater number of co-operative bacon factories in Denmark :—

	Kr.	£
Chairman of Committee—Salary	500·00	27·39
Do. Travelling and allowances ...	136·00	7·45
Certain members of Committee from 40 kr. to ...	50·00	2·73
First Auditor	500·00	27·39
Second Auditor	200·00	10·95
Seakirk Assurance	412·00	22·59
Accident do. (Employes)...	281·55	15·42
Fire do.	349·72	19·16
Burglary do.	35·65	1·95
Glass do.	8·65	·47
Local Rates	174·19	9·54
General Taxes and Building Tax	547·55	30·00
Manager's Salary	2,500·00	137·00
Do. 10 öre per pig	1,465·90	80·32
Cashier	1,400·00	76·72
General Foreman	600·00	32·88
Typewriter	600·00	32·88
Clerk	300·00	16·44
Master Butcher	2,000·00	109·60
Engineer	1,200·00	65·76
Sausage Maker	1,300·00	71·24
1 workman at 20 kr. weekly	1,040·00	56·98
3 do. at 18 ,, ,, ...	2,808·00	153·86
5 do. at 17 ,, ,, ...	4,420·00	242·19
1 apprentice at 15 ,, ,, ...	780·00	42·73
1 boy at 8 kr. weekly	416·00	22·79
1 woman at 10 kr. weekly	520·00	28·49

All the co-operative factories in Denmark, and most of the proprietary ones, carry out the curing of their bacon in the old-fashioned way by pumping the brine through insertion tubes, which are operated by manual labour. Recently, however, five factories have been established in different parts of Denmark in which the curing is carried out by the auto-cure process.

A visit was made to the Kolding factory, which is the largest, co-operative or otherwise, in Denmark. It has a membership of 7,885, and 67,046 swine were slaughtered last year. The factory has a public slaughter-house where practically all meat exposed for sale in the town of Kolding must be certified as "fit for use." Apart from the very high average price paid on delivery for the pigs of members, the Kolding Society distributed a bonus at the end of last year of 3·75 öre (three-fifths of a penny) per lb. upon all bacon supplied by them, this sum amounting to 310,483 kroner (£17,249), or an average of 4·63 kr. (5s. 1½d.) per pig. The present liabilities of the society are about 30,000 kroner (£1,650), and since the foundation of this

society in 1889 not a single member has voluntarily seceded from it.

In the Danish factories the only skilled hands employed are the butchers, one of whom is sufficient in all the smaller concerns; but as many as three or four are employed in the larger ones. The salary paid to a foreman butcher in Denmark is generally about £100 per year, and there was apparently no difficulty whatever in finding plenty of really competent men at this salary. The regular staff employed in most factories are paid at from fourteen to thirty kroners (about 15s. to 33s.) per week, according to efficiency. The Bacon Curers' Association at Copenhagen have made elaborate arrangements to prevent the dislocation of business at any particular factory through strikes, and at a meeting which took place at Copenhagen during the visit, it was arranged that in case the employés of any factory should strike, men would be immediately sent from the other factories to enable the business to be carried on. So perfect is the organisation, and so clear is the value of mutual help understood among all the factories that on the occasion of a dock labourers' strike last year at Esbjerg a wire from the central office at Copenhagen immediately secured 103 volunteers from the different factories to work at the transhipping of the bacon at this port, and in this way the strike was effectively broken down. The employés of all factories are insured against accidents.

All the factories have federated together for the purpose of insuring their bacon during transit to England, and about 1½ öre per pig killed is contributed to the funds of this federation. The bacon is insured at the rate of 24 kroner, or £1 6s. 8d., for each £1,800 sterling in value. In the case of officials having charge of money the premium of insurance, which is almost always paid by themselves, varies from 1 to 2 per cent.

The report concludes with a reference to the system adopted for the improvement of Danish swine, and observes that the principal expert in the pig-raising industry in Denmark has taken as the ideal of his work the substance of a report issued by the Irish bacon curers five years ago. The Irish curers describe the Danish bacon industry as having achieved perfection in ten years, and argue that this happy state of affairs

was brought about by the importation of English pedigree animals for crossing purposes on scientific principles, and that the State had given material assistance in every way possible. The Danish expert asserted that even yet the Danish pig is very far from anything approaching perfection, but he has taken the Irish estimate of his work as the ultimate goal of his labours. The result of his pig-breeding experiments have been to prove that the crossing of local breeds with large English boars is not by any means suited to ordinary agricultural purposes in Denmark. In his opinion foreign blood ought not to be further introduced, and his project is, therefore, to create a native race for the breeding of sows which may turn out strong and hardy, giving plenty of milk, and able to bring forth litters capable of attaining a fair size with good growing qualities, and of as good shape as possible. For this purpose a very large number of farmers' associations exist, which, with all other pig-breeding societies in Denmark, are in constant touch with the bacon factories, where the results of the breeding are subjected to the most acute criticism, and where, naturally, the most reliable opinion as to the value of pig-breeding experiments must be evolved. It may, therefore, be taken as the general opinion in Denmark that the distribution of properly bred and carefully selected sows is of as great importance as the distribution of boars.

SEASONING OF TIMBER.

The Bureau of Forestry of the United States Department of Agriculture has recently issued an interesting Report on the Seasoning of Timber, by Hermann von Schrenk, pathologist in charge of the Mississippi Valley Laboratory, Bureau of Plant Industry.

In this report reference is made to the intimate relation existing between the presence of water in wood and the rate at which timber decays. The author points out that the conditions necessary for the growth and development of wood-destroying fungi are (1) water; (2) air; (3) organic food materials; and (4) a certain amount of heat. The wood fibres and the organic substances found in the cells, such as albuminoids,

starch, sugar, and oils, form the food supply necessary for the growth of fungi. Without oxygen, no fungus growth will take place, and as there is insufficient oxygen in water and in the deeper layers of the soil, wood remains sound for a long time under such circumstances. The best examples of this necessity for oxygen can be found in the way in which fence posts and telegraph poles decay at points at or immediately below the surface of the ground, where both air and water are present in sufficient quantity. For practical purposes water is the most important factor. Without water no fungus growth, and consequently no decay, is possible. Too much water will prevent fungus growth, because it shuts off the supply of air. The amount of water necessary to permit the growth of fungi is very small. Wood freshly cut contains more than enough at all seasons of the year to support fungus growth.

From the foregoing it will be evident that the removal of water from timber brings about a condition which prevents the growth of wood-destroying fungi. In other words, perfectly dry wood will not decay, or, at most, decay will be very slow.

Seasoning is ordinarily understood to mean drying. But seasoning, von Schrenk observes, implies other changes besides the evaporation of water. Although we do not yet fully understand the difference between seasoned and unseasoned wood, it is very probable that it consists in changes in the albuminous substances in the cells and fibres of the wood, and possibly also in the tannins, resins, and other incrusting and saturating substances. Whether the change in these substances is merely a drying out, or whether it consists in a partial decomposition, is as yet undetermined. That the change during the seasoning process is a profound one there can be no doubt, because experience has shown again and again that seasoned wood fibre is very much more permeable, both for liquids and gases, than the living, unseasoned fibre. One can picture the albuminous substance as forming a coating which dries out, and possibly disintegrates, when the wood dries. The drying out may result in considerable shrinkage, which may make the wood fibre more porous. It is also possible that there are oxidising influences at work within these substances which result in their disintegration. Whatever the exact nature of the process may be, one

can say without hesitation that exposure to the wind and air brings about changes in the wood which are of such a nature that the wood becomes drier and more permeable. When seasoned by exposure to superheated steam, similar changes may take place. The water leaves the wood in the form of steam, while the organic compounds in the walls probably coagulate or disintegrate under the high temperature.

The relative ease with which so-called high and low grade timbers can be treated is another matter to which attention is called in this report. As a rule, high-grade timbers—Longleaf Pine or White Oak, for instance—are very much denser than the lower grades, such as Loblolly Pine or Red Oak. The latter usually have a higher percentage of sapwood, which can be penetrated by a fluid very much more readily than heartwood. On account of this greater porosity it is very much more economical to treat a porous wood thoroughly with a good preservative than to treat a more expensive denser wood with a cheaper preservative. The cheap and porous wood well treated will outlast the other in every instance.

One of the first steps in the process of making short-lived timbers fit for treatment consists in a proper seasoning. More benefit will *result from taking care of the short-lived timbers* than from similar treatment of those with longer life. The former are frequently short-lived because of their greater porosity, which may mean a higher water content, and which always means a greater power of absorbing and holding water or any other fluid. The economical substitution of cheap for high-priced timbers is impossible without proper seasoning. The loss from the shortened term of service of unseasoned timber is very much greater in the case of porous than of the denser kinds, which are much less permeable to water, and consequently offer greater resistance to decay. Susceptibility to decay in timber is a consequence of relatively high porosity, which may mean a high water content, and always means a greater absorptive power, and a large percentage of sapwood, which furnishes, by its stores of organic matter, food for wood-destroying fungi. Seasoning greatly lengthens its life, because it rids it as far as possible of its water and brings about a disintegration of much of the organic matter, in both ways lessen-

ing the chances for destruction of the wood by its fungus enemies. Seasoning is, therefore, of the first importance for the utilisation of cheap timbers hitherto regarded as short-lived.

According to von Schrenk, much timber is rendered unfit for use by improper methods of seasoning. Green timber, particularly when cut in the autumn or winter, contains a large amount of water. When exposed to the sun and wind, the water will evaporate more rapidly from the outer than from the inner parts of a log, and more rapidly from the ends than from the sides. As the water evaporates the wood shrinks, and when the shrinkage is not fairly uniform the wood cracks. When wet wood is piled in the sun, evaporation goes on with such unevenness that the timbers split and crack so badly as to become absolutely useless. Such uneven drying can be prevented by careful piling. A very large quantity of railway sleepers and other timber split from this cause is thrown out of use every year.

As kiln-drying is employed mostly to prevent the warping and checking of wood, and only rarely to prevent decay, it is not necessary to dwell at length on this method of seasoning.

Other methods of seasoning wood, referred to in the report, are by steaming, by immersion in water, and by boiling in oil.

The most effective seasoning is stated to be that obtained by the uniform, slow drying which takes place in properly constructed piles outdoors, under exposure to the winds and the sun. Lumber has always been seasoned in this way, and it is still the best and cheapest for ordinary purposes. The methods in use have been determined by long experience, and are probably as good as they could be made for present conditions. But the same care has not up to this time been given to the seasoning of such classes of timber as sleepers, bridge material, posts, telegraph and telephone poles, &c. These have sometimes been piled more or less intelligently, but in the majority of cases their value has been too low to make it seem worth while to pile with reference to anything beyond convenience in handling.

The following general recommendations are made in the report: Green timber should be stacked in as open piles as possible as soon as it is cut, and so kept until it is air dry. In the case of sleepers, the form of pile with seven sleepers in one row

and two in the next is the best. No timber should be impregnated until it is air-dry. Timber treated with a preservative dissolved in water should be piled after treatment for several months at least, to allow the water pressed into the wood with the salt to evaporate. Under no circumstances should timber freshly treated with a water solution be exposed to the full effects of the weather.

IMPROVEMENT OF DUNGSTEADS.

The German Agricultural Press (*Deutsche Landwirtschaftliche Presse*) of August 8th, and following issues, contains an account by Dr. Kaufmann of the application of public funds for the purpose of improving the dungsteads on the poor small farms of the Eifel district. Between 1881 and 1886, 461 farms were improved in this way. In 1889 the method of distributing assistance was modified, and took the form of equal contributions from the Province and from the District (Kreis). In any particular case the joint contribution from public funds must not exceed 40 per cent. of the total cost, the rest being borne by the farmer. Only impecunions farmers in poor districts are assisted. As a rule, no one owning more than five head of cattle is eligible for assistance, the public contributions being limited in any particular case to £4. It is a condition that the dungstead shall be sufficiently removed from the homestead, that it shall have a floor impervious to liquids, that it shall be provided with a liquid manure tank, that it shall be in a shady place, and that no water shall reach it except what falls direct from the clouds. The dungstead must also be sufficiently large for the requirements of the holding, the standard being about four square yards of ground space per cow, three square yards per horse, and one square yard per pig. In the district of Malinedy about 2,800 improved dungsteads have thus been provided, or more than half of the whole number. The saving to the district of plant food that would otherwise have been lost in the liquids is regarded as a splendid return on the capital invested.

CATTLE BREEDING SOCIETIES IN EUROPE.

In a paper read before the recent International Agricultural Congress at Rome, M Pecile, President of the Agricultural Association of Frioul, in the Venetian Alps, gave a short history of the development of breeding societies in various European countries. He placed England at the head of the list as the country which first undertook the systematic improvement of domestic animals. "Always eminently practical, the English breeders have succeeded in an admirable manner in obtaining good zootechnic and commercial results, not indeed with Government aid, but wholly by private enterprise."

M. Pecile's paper contained considerable information with regard to herd-books. Holland was apparently the first Continental country to adopt them, Germany followed, and the system gradually extended throughout Central Europe. In France the introduction of herd-books is of quite recent date, although as early as 1853 the Government had undertaken to keep a register of shorthorns. It was not, however, until 1883 that herd-books were started for local breeds, *e.g.*, Norman, Flemish, &c., and since that date local registers have been established throughout the country.

The improvement of cattle in Denmark was systematically established by the Agricultural Society of Jutland in 1875, and in 1880 the first show of pure bred cattle was held at Viborg. Thirteen new societies were afterwards united into a federation, and the movement extended so rapidly that by the year 1900 there were in Denmark 492 breeding societies, comprising 12,000 members, with 37,500 registered cows and 518 bulls.

Analogous progress has taken place in Belgium, partly owing to the action of the Government, which in 1895 decided to subsidise local "syndicates" and encourage them by various other means. This official assistance is now given primarily through the "National Society for the Improvement of Dairy Cattle."

Cattle-breeding syndicates were first established in Switzerland in 1888, and the number had risen to 182 by 1893. In 1894, the Federal Government passed a law appropriating a subsidy of not less than 400,000 francs annually for the

improvement of cattle. Grants are also made by various local authorities.

The various States of the German Empire assist cattle-breeding societies more or less, and the results which have been obtained in the Grand Duchy of Baden are taken as an object lesson throughout Germany. The movement in Baden commenced about sixty years ago, and at the present time the State annual subsidy occasionally reaches the sum of £75,000. Veterinary officers, paid from public funds, superintend the selection and registration of pedigree cattle, as well as the work of the local societies. As a rule, the bulls belong to the local authorities, who are required by law to keep official lists of service. The animals are, however, under the direct control of the State, which, besides financial allowances, grants various other privileges, such as reduced railway rates, &c. In Bavaria subsidies amounting to £25,000 annually are granted by the Government to sixteen syndicates of seventy-six breeders' societies, which also receive aid from other sources.

The increase of these associations has been very remarkable throughout Germany. In 1900 there were 851 societies, of which 668 limited their work to the improvement of cattle.

The system of syndicates which exists in Central Europe has not yet been established in Italy, where, however, the Government subsidises cattle-breeding stations, and indirectly renders assistance in other ways. Several societies and herd-books are, moreover, in existence in various provinces of the peninsula.

MINERAL MATTER IN FOOD.

It is not often that much is heard in this country of the subject of supplying farm stock with mineral matter in their food, but the advertisement columns of foreign periodicals show that a considerable trade is done in such forms of nutriment on the Continent. The most important mineral ingredient of food is believed to be phosphate of lime, and Dr. Schenke, of the Agricultural Research Station of Breslau, has contributed a useful abstract of the results of its use to the *Landw. Versuchs-Stationen* for the current year.

It seems to be generally agreed that the most suitable form of phosphate to introduce into the food of animals is precipitated phosphate. This is a bye-product of glue, gelatine, and similar works, where bones are treated with sulphuric acid, the phosphate thus rendered soluble being subsequently precipitated by the addition of lime, after which it is dried. The resulting product contains usually between 30 and 40 per cent. of phosphoric acid, or, calculated as tricalcium phosphate, say, 65 to 85 per cent. In point of fact, most of the phosphoric acid is in the form of dicalcium phosphate, a substance insoluble in water, but readily soluble in the gastric and other digestive juices of the stomach and intestines.

The most serious impurities are likely to be sodium fluoride and arsenic, but it is seldom that either appears in dangerous quantities, though they should always be tested for where precipitated phosphate is to be given to stock. It is recognised that the most rational way to keep animals supplied with phosphates is to give them food that naturally contains a sufficient amount. But where a deficiency manifests itself in the appearance of rickets, and similar weakness of the bones of young stock, the artificial supply of phosphates becomes of importance. Deficiency in phosphates and other mineral matters is most likely to occur where animals are chiefly getting roots and meal, and where their drink consists of soft water. It is recommended that pregnant sheep and swine be given daily about ½ oz., and mares and cows about 1½ oz. of precipitated phosphate, the object being to strengthen the skeleton of the unborn young.

From the time of weaning until about full-grown, foals and calves may be allowed ¼ to ½ oz., and lambs and pigs about half as much per day.

It is now many years since Lawes and Gilbert demonstrated by experiment the importance of digestible mineral matter in the food of animals, but the subject might again usefully engage attention.

IMPORTATION OF LIVING PLANTS INTO GERMANY.

Inquiries have been addressed to the Board of Agriculture as to the conditions under which living plants can be imported

into Germany from the United Kingdom. German legislation formerly absolutely prohibited the importation of such plants from countries which have not adhered to the International Phylloxera Convention, among these being the United Kingdom; but, by a decree of April 7th, 1887, living plants not coming under the category of vines may be imported into Germany from countries which are not participants in this Convention under the following conditions:—

The plants can be imported only through certain Customs' Houses, including those at the ports of Flensburg, Danzig, and Stettin.

The plants must be tightly packed, but in such a way as to allow an easy inspection both of themselves and of their packing. The plants will not be admitted until they have undergone an examination, made at the expense of the consignee, which proves that there is no suspicion of phylloxera. Specialists are appointed by the Imperial Chancellor to carry out these examinations.

The consignor of the plants must send a declaration with the consignment, by which he either binds himself to bear the costs of the examination or commissions the consignee, or a representative of the latter, with full powers to pay such costs. Should this declaration not be provided the consignee is notified of the fact, and should he send no reply within a certain period the consignment is destroyed.

Should any portions of vine plants be found in the packing the authorities may either destroy or send back the whole consignment. The costs of examination amount to two marks (two shillings) per hour up to a total sum of twelve marks (twelve shillings). Under certain circumstances these charges may be increased or reduced.

PRIZES OFFERED BY RUSSIAN GOVERNMENT FOR MILK STERILISERS.

The Board of Agriculture have received information through the Foreign Office that the Russian Department of Agriculture has notified its intention of offering two prizes of 1,500 and

500 roubles respectively, at an exhibition to be held in the Agricultural Museum at St. Petersburg, commencing on 2nd April, 1904, for the best milk sterilising apparatus, chiefly for skim milk.

Intending competitors must signify their intention of entering to the Department of Agriculture at St. Petersburg not later than the 28th February, 1904.

The prizes will only be awarded to apparatus suitable for small dairy farms, capable of dealing with 43 to 54 gallons of milk per hour, heated to a temperature of not less than 70 degrees Centigrade, which can be raised by means of steam at half atmospheric pressure, or by hot water to 100 degrees Centigrade if necessary.

The apparatus must, in addition to being furnished with a stirring appliance for the warmed milk, be of simple yet solid construction, and capable of being worked by one person. It must also serve in an equal degree as a steriliser and warmer for milk and cream, and be furnished with special appliances for regulating the temperature, not only by means of a regulator for the passage of the milk, but also by means of one controlling the supply of steam or hot water.

BRITISH BREEDING STOCK IN RUSSIA.

In a report on the agriculture of the Odessa district of Russia for the year 1902, H.M. Consul-General states that some of the results of the crossing of native breeds of cattle with British shorthorns were shown at Rostov, where there was a large sale of cross-bred cattle. Prince Tscherbatof, the President of the Imperial Agricultural Society, interests himself greatly in this matter, and a movement is on foot to supply peasants with the services of good class bulls, which would very generally be imported from the United Kingdom or Germany. At the Rostov market 12 British shorthorn bulls fetched 500r. each (£52 10s.), and half-bred Kalmuck-and-shorthorned one-year-old bulls sold freely at from 100r. (£10 10s.) to 350r. (£36 15s.), the latter price being given for a one-year-old cross-breed by the well-known British bull "Saturn."

At the Elizabetgrad Exhibition much attention was attracted by two pair of enormous cross-bred shorthorn (British) and Ukrainsky draught oxen. They caused admiration and surprise, for in Russia shorthorn crosses are held to be unsuitable for draught. Each of these pairs proved themselves able to draw a weight of 400 poods (about 6½ tons) on level ground.

Shropshire rams are increasingly bought for crossing with merinos. The resulting two-year-old wethers command better prices than the pure merino wethers, which give less and poorer mutton. The local price in South Russia and the Caucusus is 7r. to 7r. 50c. (14s. 7d. to 15s. 8d.), and, when sold in spring, delivery is generally arranged for September.

[*Foreign Office Consular Reports, No. 2,997, Annual Series.*]

AGRICULTURAL CO-OPERATION IN GERMANY.

During the last ten or fifteen years the German agricultural co-operative societies have considerably increased in number. They were originally founded on the principles laid down by Schultze-Delitzsch and Raiffeisen, and are distributed partly in the towns, partly in the country districts.

Of the total number of co-operative societies in Germany, which amounted to 16,500 in 1900, the agricultural societies formed 12,736, or 77 per cent.; in the year 1893 the figures were respectively 4,975 and 59 per cent. out of 8,400.

The following table shows the nature and distribution of the different co-operative societies for agricultural purposes:—

Description of Agricultural Co-operative Society.	Number and Distribution.		Objects.
	Prussia.	Other German States.	
Savings and loan banks	4,455	3,899	Financial matters
Purchasing societies ...	426	578	Purchase of artificial manures and fodder stuffs, coals, machinery, tools, &c.
Productive and selling societies	553	116	Contain many branches:—(*a*) Sale of seed, fruit, vegetables, and produce of all kinds; (*b*) silo societies; (*c*) the German Spirit Syndicate; (*d*) sale of cattle.
Dairy produce societies	1 261	421	Production and sale of dairy produce.

A study of the distribution of the co-operative societies shows that they thrive best in districts where small holdings are predominant. For small farmers and peasants with independent holdings they seem to be of great value, as they free them from the hands of middlemen and from the influence of usury.

[*Foreign Office Report, Miscellaneous Series, No.* 594.]

Verification of Lister-Gerber Milk Testing Apparatus.

The Board of Agriculture have made arrangements with the Committee of the National Physical Laboratory for the examination of the Lister-Gerber milk testing apparatus; and the Committee of the Laboratory are now prepared to receive, for the purpose of verification, the pipettes, measuring glasses, and test bottles used in the Lister-Gerber and other similar methods of testing milk. Standards of accuracy have been laid down, and all instruments which pass the test will be marked with the Laboratory monogram. The fees which will be charged are as follows:—Test bottles, or pipettes with one mark, 6d.; measuring glasses with one mark, 9d.; graduated pipettes tested at five points, 1s. 6d.; and measuring glasses tested at five points, 1s. 9d. Half these fees are charged in the case of instruments failing to reach the required standard. Copies of the regulations for the examination of such testing apparatus can be obtained upon application to the Director, National Physical Laboratory, Bushy House, Teddington.

Cultivation of Ginseng.

Inquiries are frequently made as to the possibility of cultivating the ginseng plant (*Aralia quinquefolia*) in England, and it is accordingly thought desirable to state that all attempts made with it at the Royal Gardens, Kew, have so far met with failure. There is, no doubt, a good market at present for the dried root; but ginseng plants are most exacting in their requirements, and it is evidently a very intractable plant, quite unsuited to ordinary agricultural or horticultural methods.

Importation of Trees, &c., into Cape Colony.

The Board of Agriculture are informed that the Governor of the Cape Colony has issued regulations prohibiting the introduction into that Colony, except by sea or by post, of trees, plants, and portions thereof, *e.g.*, cuttings, roots, tubers, and bulbs; and of fruit of all kinds grown elsewhere than in South Africa. It is, moreover, absolutely forbidden to import grape vines or any portion or fruit thereof; and, from January 1st, 1904, peach stocks and peach stones. After that date, the importation of any fruit tree or portion thereof (with the exception of fruit, seed, seedling stocks for budding or grafting purposes, and blight-proof stocks for apples) will be allowed only by special permission from the Minister for Agriculture at Cape Town. No permit will be granted for the introduction of more than ten trees or one hundred cuttings of any one variety; nor will permits be issued for more than an aggregate of one hundred trees, or one thousand cuttings, to any party during one year. Imported plants, fruit, and their packages will be officially examined, and trees and woody plants will be fumigated before delivery to the consignees. The plants must be disinfected or destroyed if found infested with any injurious insect or plant disease. The regulations do not apply to any consignment imported in bond for places beyond the borders of the Colony, or to canned, dried, or otherwise preserved articles in which there is no longer any plant life. Any person contravening these regulations is liable to a fine or imprisonment not exceeding £100 or six months respectively.

Exemption from Duty of Molasses used for Food for Stock.

Section I. of the Revenue Act, 1903, provides that molasses imported into Great Britain or Ireland shall not be liable to duty under Section II. of the Finance Act, 1901, if it is to be used solely for the purpose of food for stock, and such conditions are complied with in respect thereof as to proof, security, and otherwise as may be imposed by the Commissioners of Customs for the

purpose of protecting the Revenue. An allowance at the rate of one shilling per hundredweight shall be made to a refiner on molasses produced in Great Britain or Ireland from sugar on which duty has been paid on importation, if the molasses is to be used solely for the purpose of food for stock, and such conditions are complied with in respect thereof as to proof, security, and otherwise as may be imposed by the Commissioners of Customs or Commissioners of Inland Revenue as the case requires for the purpose of protecting the Revenue.

Quarantine on Cattle Imported into Canada.

By an Order in Council dated 1st August, 1903, the quarantine period for cattle imported into Canada from Great Britain, Ireland, and the Channel Islands is reduced to sixty days from the date of shipment. The quarantine period was formerly ninety days.

HARVEST AND CROP REPORTS.

WHEAT CROP IN INDIA.

The "Final General Memorandum" on the wheat crop of 1902-3 states that the total acreage under wheat was rather less than in the previous season, viz., 22,775,160, as compared with 23,447,089 acres, but the yield was greatly above that of the preceding year, and also above the average. The yield proved best in the three most important districts of Punjab, the United Provinces (Agra and Oudh), and the Central Provinces; while the more southern districts, where the amount of wheat raised is much less considerable, generally had a deficient harvest. The acreage and production in the different districts are shown in the following table:—

Province.	Area in 1902-3.	Production in 1902-3.	Production in 1901-2.	Average Production of preceding ten years.
	Acres.	Tons.	Tons.	Tons.
Punjab	7,111,700	2,389,897	1,846,332	1,913,551
North-West Frontier ...	822,900	234,594	159,279	—
United Provinces ...	6,926,164	2,972,497	2,401,940	2,047,785
Bengal	1,445,900	501,100	391,500	493,100
Central Provinces ...	2,272,482	666,040	571,040	480,553
Bombay	1,617,891	502,508	179,034	507,293
Sind	301,648	68,531	109,009	143,469
Berar	216,955	17,498	6,180	45,244
Hyderabad	508,760	43,215	38,853	55,317
Rajputana	774,743*	180,300*	103,869	299,309
Central India	770,894*	198,140*	256,214	315,919
Mysore	5,123	531	256	300
Total	22,775,160	7,774,851	6,063,506	6,301,840†

* Incomplete. † Excluding North-West Frontier.

CROPS IN THE UNITED STATES.

Preliminary returns as to the wheat crop of the United States indicate that the area sown with spring wheat was about 17,257,000 acres, a decrease of 364,000 acres, or 2·1 per cent.

from the revised estimate of the acreage sown last year. Of winter wheat the yield is put at about 410,000,000 bushels, or an average of 12·4 bushels per acre, as compared with 13·8 bushels last year.

The area under maize has been estimated to be about 89,800,000 acres, a decrease of about 4,200,000 acres, or 4·5 per cent., from the area planted last year.

The area under oats has been estimated at 27,732,000 acres.

CROPS IN FRANCE.

The official reports on the condition of crops in France indicate that there was considerable improvement in the prospects of the corn crops during the month of July. In the majority of the departments the condition was described as "good" or "fairly good," the reports as regards wheat and spring oats being generally rather better than those concerning rye, barley, and winter oats.

Clover and grass, and potatoes had also improved, and were described as "good" or "fairly good." Beetroot was mostly only "fairly good"; while the condition of apples was nearly everywhere either poor or altogether bad.

CROPS IN HUNGARY.

Estimates of the Hungarian corn harvest, issued on August 15th last, give the following figures of area and production this year :—

Crop.	Area.	Production.	Yield per Acre.
	Acres.	Bushels.	Bushels.
Wheat	8,023,000	149,246,431	18·6
Rye and Mixed Corn ...	2,687,279	44,937,356	16·7
Barley	2,531,292	57,787,557	22·8
Oats	2,432,460	66,157,863	27·2

OFFICIAL PUBLICATIONS.

Board of Agriculture—Annual Reports of Proceedings under the Diseases of Animals Acts, &c. [*Cd.* 1520.] *Price* 11*d*.

This volume contains a review of the proceedings of the Animals Division of the Board in the form of reports by the Chief Veterinary Officer and by the Assistant Secretary in charge of that Division. It also contains a list of the Orders of the Board in force on January 1st, 1903, and statistical tables relating to the number of animals in Great Britain, the number of animals imported from Ireland, the number of animals imported from foreign countries, diseases amongst animals in Great Britain, and the international trade in animals.

Mr. Cope devotes a considerable part of his report to a review of the investigations which have been made into the cause, propagation, and means of transmission of the various contagious and infectious diseases of animals. The subject is, he points out, one of special interest, because all the measures adopted for the suppression of contagious diseases of animals are necessarily based upon a knowledge of the laws which regulate the spread of those diseases. He then proceeds to examine the question in relation to each of the diseases dealt with under the Diseases of Animals Act of 1894, namely, cattle plague, pleuro-pneumonia, foot-and-mouth disease, sheep scab, sheep pox, swine fever, anthrax, glanders, and rabies. The remainder of the report is devoted to a review of the diseases of home stock during the year 1902, with special reference to the outbreak of foot-and-mouth disease which occurred in Kent in the spring of that year. A short account of the experiments which have been made with regard to the use of mallein as a diagnostic in glanders and the question of whether or not it possesses curative properties [Cd. 1396] is also given. The outbreak of foot-and-mouth disease in the United States of America is also discussed.

The report of the Assistant Secretary relates more particularly to the executive action taken by the Department in connection with the diseases which are directly administered by the central authority, and the precautions taken to guard the country from the introduction of diseased animals. The reasons which weighed with the Board in taking action in any particular direction are set forth, and the effect of the policy adopted is discussed. The steps taken to prevent the spread of foot-and-mouth disease, should it have appeared in any of the cargoes from the New England States, are described. In connection with the prohibition of the importation of animals from Argentina on account of that disease, figures are given showing that the total amount of beef and mutton imported from that country was, in 1902, about 7 per cent. greater than in 1899 (prior to prohibition), and it is also shown that the predominant factors in the rise of the price of meat in Great Britain were the shortage of the supply from the United States, due largely to the failure of the maize crop the year before, and, in a lesser degree, to the shortage of the supply from Australia, due to the continued drought in that continent. A large portion of the report is devoted to the discussion of the position as regards swine fever, which was, at the close of the year, unusually favourable, the figures for 1902—1,688—showing a decline of 252 outbreaks as compared with the lowest figures previously recorded. The improvement had become apparent in the summer months of the year under review, and the Board determined to recommend to all local authorities the adoption of well-considered regulations designed to protect their districts from the risks which would follow the importation of diseased swine, regard being had to the particular requirements of the locality. The form of regulations suggested is printed as an appendix to the report. As examples of the good effects to be expected from the adoption of such regulations, the experience of the counties of Cheshire, Somerset, and Wilts are quoted. The swine fever position is graphically shown by maps relating to the years 1900, 1901, and 1902, and a table is given in the appendix showing the number of outbreaks of swine fever in each county of Great Britain during each year from 1894 to 1902. In connection with sheep scab, the powers possessed by local authorities

under the existing Sheep Scab Order are emphasised, and the statistics of outbreaks for the year, accompanied by maps showing graphically the position for three years, are given. A summary of the cases of rabies which occurred in Wales during the year is included in the report, particulars are given as to the special precautions adopted in connection with rabies in that country, and the operation of the Muzzling and Control of Dogs Order and its effects are discussed. Some paragraphs are devoted to the casualties in the carrying trade of foreign and Irish animals, in which are included tables showing the number of animals carried from various countries and the number lost.

The statistical tables included in the volume will be found to be of considerable interest to agriculturists.

Local Authorities (Acquisition of Land). [*H.C.* 182.] *Price* 4*d.*

This return shows the extent to which local authorities in England and Wales utilised their statutory powers for the acquisition of land for allotments, small holdings, and other purposes between the 24th June, 1897, and the 31st March, 1903.

The extent of land acquired for allotments was 3,783 acres, the number of tenants accommodated being 12,730. Of this area, 290 acres were purchased and 3,287 acres hired by agreement, while 207 acres were compulsorily hired. Local authorities in Norfolk displayed greater activity than those in any other county in acquiring land for allotments, the area acquired being 783 acres, or more than four times the amount in any other county. In each of the counties of Berks, Hereford, and York, North Riding, less than 5 acres were acquired, while in Huntingdonshire, Rutland, Westmorland, and eight Welsh counties no land was acquired for allotments.

Only three county councils and one county borough availed themselves of their powers to acquire land for small holdings, 54 acres being purchased and 46 acres hired for this purpose.

The total area of land acquired by parish councils for purposes other than allotments amounted to 711 acres, of

which 437 acres were for recreation grounds, 140 acres for sewage farms, and 123 acres for burial grounds and cemeteries.

Local Authorities in Scotland (Technical Education), 1901–2. [*H.C.* 159.] *Price 7d.*

This return indicates that the total amount of the residue grant paid to county councils, burgh councils, and commissioners of police burghs, in Scotland, in respect of the year 1900–1 was £79,449, of which £56,110 was allocated to purposes of technical education, and £23,339 to the relief of rates. Out of the 33 county councils 22 applied the whole of the grant to technical education, and 7 a part of it, while 4 applied the grant wholly to the relief of rates. Of the 206 burghs and police burghs, 54 applied the whole and 73 a part of the residue grant to technical education; 79 applied the whole to relief of rates.

No amount was applied to the building or maintenance of science and art schools, art galleries, or museums out of the local rate under the Public Libraries Acts. The total amount available for purposes of technical education during the year 1901–2, including balance in hand, contributions under Section 2 (5) c. of the Education and Local Taxation Account (Scotland) Act, 1892, bank interest, &c., was £77,733, and the total amount expended was £58,407, of which £13,577 was handed over to Secondary Education Committees.

Technical Education (Application of Funds by Local Authorities). [*H.C.* 200.] *Price 1s. 3d.*

This return shows the amount spent on technical education by local authorities in England and Wales—with the exception of five which have made no return—during the year 1901–2.

Particulars are also given of the amounts raised by loan on the security of the local rate under the Technical Instruction Act, 1889—mainly for the erection of science, art, and technical schools.

The total amount of the residue grant received under the Local Taxation (Customs and Excise) Act by the councils of counties and county boroughs in England (excepting the county of Monmouth) was £855,258, of which £817,970 was appropriated to educational purposes, and £37,288 to the relief of rates. Of the 49 county councils, 41 applied the whole of the residue to technical education; and of the councils of the 64 county boroughs, 59 devoted the whole to the same purpose. Many counties, boroughs, and urban districts also devoted money raised by rate to technical education.

The total amount expended on technical education during the year was £1,008,948.

The total amount of residue grant paid to the 13 county councils and the councils of the 3 county boroughs in Wales and Monmouth was £41,042. These local authorities devoted the whole of it to intermediate and technical education, and the councils of 8 counties, 3 county boroughs, 4 boroughs, and 8 urban districts made grants out of the rates under the Technical Instruction Acts. The total amount expended on technical education under the Technical Instruction Acts during the year was £48,451.

Ireland: Report of Proceedings under the Diseases of Animals Acts for the year 1902. [Cd. 1583.] Price 6½d.

During the year 1902, Ireland again enjoyed complete immunity from pleuro-pneumonia and foot-and-mouth disease. Glanders or farcy was reported in 10 instances, as compared with 5 in 1901, while the number of cases of parasitic mange was 161, or 13 less than in 1901. No outbreak of anthrax was

recorded, the number of outbreaks of this disease having been only 2 in each of the previous four years.

The outbreaks of sheep scab reached a total of 613, which was 68 in advance of the previous year's figures. Swine fever, on the other hand, decreased from 220 cases in 1901 to 166 cases last year.

There is good ground for hoping that rabies has been eradicated from Ireland, no outbreak of this disease having been confirmed since April, 1901.

British Museum (Natural History)—First Report on Economic Zoology. By F. V. Theobald, M.A.

This contains a series of reports made by the Natural History Department of the British Museum on Economic Zoology during 1901 and 1902. In an introduction the Director of the Museum gives a classification of animals from the point of view of their utility, whether captured or bred for food or other purposes, and injuriousness to man, either directly or indirectly by causing disease in stock and destroying crops, &c.

The first part of the report deals with the work performed, for the Board of Agriculture, under the arrangement by which the Natural History Museum acts as their technical advisers upon zoological questions. To assist the Director in this work Mr. Theobald has been, since 1901, employed by the Trustees of the Museum, with the view of furnishing scientific information upon economic zoology generally. The greater number of questions referred to the Museum by the Board during the period related to insects and other pests of crops, among others eelworm and frit fly in oats, beetles and larvæ on roots, chafer beetles, leather jackets, wireworms, the Colorado beetle, millipedes and centipedes, mustard beetles, various insects on fruit trees, land bugs on chrysanthemums, ants, maggots on cabbages, furniture beetles, clothes moths, beetles in bacon, weevils in stored corn,

tapeworms in sheep, &c. The majority of these reports, when of general interest to agriculturists, have been already published either in full or summarised in this *Journal.*

Four leaflets on insects were prepared and 31 were revised by the Museum for the Board.

Numerous correspondents wrote directly to the British Museum for advice on various subjects, and the replies to these form the second part of the report. Among these are reports on mosquitoes at Blackheath, horse worms, depluming scabies in fowls, various insect pests on fruit trees, flowers, forest trees, &c. This section also includes a detailed report on the various species of daddy longlegs, or crane flies.

The information supplied to the Foreign and Colonial Offices, which forms the third section of the report, comprises amongst other subjects correspondence concerning the tsetse fly, white ants and locusts in the Soudan, the marine resources of the West Indies, and the Ceylon Pearl Fisheries.

In connection with the work on economic zoology, it may be pointed out that there are on exhibition at the Natural History Museum numerous cases illustrating the life history of various animals important to man, including models showing the injury caused to farm and fruit crops by insects, &c.

LIVE WEIGHT PRICES OF CATTLE.

The returns received from the twenty-one places in Great Britain scheduled under the Markets and Fairs (Weighing of Cattle) Act, 1891, in the second quarter of 1903 show that the number of cattle entering the markets was 328,675 as compared with 336,829 in the corresponding period of 1902. There was a rather considerable decrease in the number of sheep exposed for sale in these markets, the total being 120,000 less than in 1902.

Animals.	2nd Quarter, 1903.	2nd Quarter, 1902.
CATTLE:	No.	No.
Entering markets	328,675	336,829
Weighed	45,614	44,348
Prices returned	38,573	36,332
Prices returned with quality distinguished ...	31,420	29,158
SHEEP:		
Entering markets	1,067,715	1,187,169
Weighed	11,201	13,018
Prices returned with quality distinguished ...	8,196	9,240
SWINE:		
Entering markets	115,034	100,108
Weighed	922	840
Prices returned with quality distinguished ...	906	840

The percentage of cattle weighed was somewhat higher than that recorded in the corresponding quarter of last year, the increase being chiefly due to the larger proportion of animals returned as weighed at Shrewsbury. For the first time since 1900, use appears to have been made of the weighbridge at

York Market, although only in the case of 44 cattle and 87 pigs.

The weighing of sheep is practised to only a small extent at a few markets, but it is to be noted that in the quarter under review 1,059 sheep were returned as weighed at Wakefield.

As on previous occasions, a sufficient number of complete returns, showing both the price and quality of cattle weighed, were obtained from thirteen markets, and from these the average prices shown in the table below have been calculated.

PLACES.	INFERIOR or Third Quality.			GOOD or Second Quality.			PRIME or First Quality.		
	Number.	Price per Stone.	Price per Cwt.	Number.	Price per Stone.	Price per Cwt.	Number.	Price per Stone.	Price per Cwt.
		s. d.	s. d.		s. d.	s. d.		s. d.	s. d
Carlisle ...	227	3 5½	27 8	266	3 10	30 8	1,782	4 5½	35 8
Leicester ...	—	—	—	19	3 9	30 0	188	4 7¼	36 10
Leeds ...	—	—	—	298	4 0¼	32 2	571	4 6	36 0
Liverpool ...	104	3 5½	27 8	131	3 11¾	31 10	571	4 6¾	36 6
London ...	6	3 7	28 8	151	4 5¼	35 10	827	4 10	38 8
Newcastle ...	—	—	—	63	4 2¼	33 10	1,284	4 7½	37 0
Shrewsbury	164	3 11½	31 8	398	4 4½	35 0	203	4 8	37 4
Aberdeen ...	1,411	3 4¼	26 10	1,851	4 3¾	34 6	2,256	4 7¼	36 10
Dundee ...	630	3 2¾	25 10	1,359	4 3¼	34 2	797	4 7½	37 0
Edinburgh ...	—	—	—	2,979	4 5¾	35 10	221	4 6½	36 2
Falkirk ...	99	4 1¼	32 10	378	4 5¼	35 6	459	4 8	37 4
Glasgow ...	237	4 4¼	34 10	689	4 5¾	35 10	2,098	4 7½	37 0
Perth ...	328	3 10¾	31 2	965	4 3½	34 4	790	4 7	36 8

Comparing these prices with those given in the corresponding table published last quarter, the figures, it will be observed, show a considerable reduction in practically every instance.

Taking the returns from England and Scotland together, the trend of prices for each month of the present year is shown in the following table, and may be compared with the rates prevailing in the same months of 1902.

Months.	Prime or First Quality.		Good or Second Quality.	
	1903.	1902.	1903.	1902.
	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.
January	37 8	36 2	36 2	34 6
February	37 0	36 4	35 0	34 6
March	37 0	36 4	35 4	34 6
April	37 2	37 8	35 2	35 10
May...	36 8	39 8	34 6	37 4
June	36 8	42 8	34 10	40 4
July...	37 0	41 4	34 10	39 8

There appears to have been on the whole no such striking variation in values during the present season as marked the summer months of 1902. Second quality cattle fell to 35s. in February, and the fluctuations since then have been unimportant. First quality cattle show similar characteristics, the variation over the first seven months of the present year not exceeding 1s. per cwt., whereas in 1902 the maximum and minimum prices in the same period differed by no less than 6s. 6d. per cwt.

The sale of fat cattle by live weight at an agreed price per stone or per cwt. was only reported from six markets in regard to 2,527 cattle, the majority of these transactions taking place at Glasgow.

A number of store cattle were also reported to have been weighed during the second quarter of 1902, and prices were furnished in respect of 6,414 head. Nearly the whole of these were reported from Shrewsbury, and comparing the returns received from this market with those for the corresponding period of 1902, it would seem that rather higher prices were realised in 1903, the value of second quality animals being returned at 36s. 10d. as against 35s. 6d., while for first quality cattle 40s. 2d. per cwt. was obtained as against 39s. 6d. per cwt. in 1902.

The table giving the usual particulars for the quarter is appended.

CATTLE, SHEEP, AND SWINE *entering the Markets and Marts of the undermentioned Places, with the Number Weighed, as returned by the Market Authorities in the* SECOND QUARTER *of* **1903**, *under the Markets and Fairs* (*Weighing of Cattle*) *Act*, 1891 (54 *and* 55 *Vict. c.* 70).

PLACES.	Cattle.			Sheep.			Swine.		
	Total Number entering the Markets or Marts.	Number Weighed.	Number Weigh'd for which Prices were given.	Total Number entering the Markets or Marts.	Number Weighed.	Number Wgh'd for which Prices were given.	Total Number entering the Markets or Marts.	Number Weighed.	Number Wgh'd for which Prices were given.
ENGLAND.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
Ashford ...	3,573	35	—	23,852	—	—	5,865	—	—
Birmingham ...	6,095	—	—	17,472	—	—	55,510	—	—
Bristol	21,936	—	—	26,198	—	—	—	—	—
Carlisle ...	20,146	2,275	2,275	66,124	—	—	3,420	—	—
Leicester ...	18,374	299	275	17,391	—	—	1,768	—	—
Leeds	10,261	869	869	39,420	998	998	—	—	—
Lincoln ...	3,108	—	—	19,969	—	—	4,075	55	55
Liverpool ...	7,788	806	806	89,588	1,878	1,878	148	1	1
London ...	13,355	2,836	984	147,070	2,193	—	110	—	—
Newcastle-upon-Tyne ...	24,465	1,347	1,347	77,115	—	—	8,838	615	615
Norwich ...	37,413	87	76	45,522	—	—	8,395	—	—
Salford ...	21,906	533	—	151,458	—	—	522	—	—
Shrewsbury ...	21,035	9,913	6,901	18,846	—	—	9,624	—	—
Wakefield ...	17,210	835	130	53,469	1,059	293	2,674	76	60
York	28,497	44	44	21,742	—	—	1,705	87	87
SCOTLAND.									
Aberdeen ...	12,506	5,559	5,559	42,739	4,267	4,267	3,670	—	—
Dundee ...	5,513	2,806	2,806	6,368	431	431	854	—	—
Edinburgh ...	16,908	7,492	*3,305	70,371	30	—	2,413	—	—
Falkirk ...	3,368	936	936	2,013	—	—	21	—	—
Glasgow ...	15,131	3,893	3,024	68,250	16	—	1,512	—	—
Perth... ...	20,087	5,049	*2,083	62,738	329	329	3,910	88	88
TOTAL for ENGLAND ...	255,162	19,879	13,707	815,236	6,128	3,169	102,654	834	818
TOTAL for SCOTLAND ...	73,513	25,735	*17,713	252,479	5,073	5,027	12,380	88	88
Total ...	328,675	45,614	*31,420	1,067,715	11,201	8,196	115,034	922	906

*Prices for 4,187 cattle in addition to the above were quoted from Edinburgh and for cattle from Perth, but without distinguishing the quality.

PRICES OF MEAT, CORN, AND DAIRY PRODUCE.

AVERAGE PRICES of DEAD MEAT, per 8 lb., at the LONDON CENTRAL MEAT MARKET, during the Second Quarter of 1903, and during the Months of June, July, and August, 1903.

(*Compiled from the prices quoted weekly in the "Meat Trades' Journal."*)

DESCRIPTION.	2ND QUARTER.	JUNE.	JULY.	AUGUST.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
BEEF :—				
Scotch, short sides	4 3 to 4 6	4 3 to 4 7	4 5 to 4 8	4 4 to 4 7
,, long sides	3 11 ,, 4 1	3 10 ,, 4 2	4 0 ,, 4 2	—
English...	3 9 ,, 3 11	3 8 ,, 3 11	3 8 ,, 3 10	3 7 ,, 3 10
Cows and Bulls	2 1 ,, 3 2	2 0 ,, 3 0	2 5 ,, 3 0	2 3 ,, 3 2
American, Deptford killed ...	3 6 ,, 3 8	3 3 ,, 3 6	3 6 ,, 3 8	3 5 ,, 3 8
,, Birkenhead killed...	3 5 ,, 3 7	3 2 ,, 3 5	3 4 ,, 3 7	3 4 ,, 3 7
Argentine, Deptford killed ...	2 10 ,, 3 4	2 8 ,, 3 1	—	—
American, Refrig. hind-quarters	3 7 ,, 3 9	3 7 ,, 3 9	3 8 ,, 3 11	3 8 ,, 3 10
,, ,, fore-quarters	2 6 ,, 2 8	2 2 ,, 2 4	2 4 ,, 2 6	2 2 ,, 2 4
Australian, Frozen, hind-quarters	2 7 ,, 2 8	—	—	—
,, ,, fore-quarters	2 3 ,, 2 4	—	—	—
River Plate, ,, hind-quarters	2 11 ,, —	2 11 ,, —	2 10 ,, —	2 10 ,, —
,, ,, fore-quarters	2 3 ,, —	1 11 ,, 2 0	1 9 ,, —	1 8 ,, —
New Zealand, ,, hind-quarters	3 0 ,, 3 1	3 1 ,, 3 3	2 10 ,, 2 11	2 9 ,, 2 10
,, ,, fore-quarters	2 3 ,, 2 4	2 0 ,, —	1 9 ,, —	1 8 ,, 1 9
MUTTON :—				
Scotch	4 8 ,, 5 5	4 6 ,, 5 5	4 9 ,, 5 4	4 9 ,, 5 3
English	4 4 ,, 5 0	4 2 ,, 5 0	4 0 ,, 4 8	4 2 ,, 4 11
Ewes	3 7 ,, 4 0	3 6 ,, 3 10	3 2 ,, 3 8	3 7 ,, 4 0
Continental	—	—	3 0 ,, 3 4	—
New Zealand, Frozen... ...	2 2 ,, 2 11	2 0 ,, 2 7	2 2 ,, 2 8	2 6 ,, 2 11
Australian, Frozen	2 4 ,, 2 5	—	—	—
River Plate, Frozen	2 4 ,, 2 5	2 2 ,, —	2 3 ,, 2 4	2 8 ,, —
LAMB :—				
English	5 7 ,, 6 11	5 3 ,, 6 6	5 1 ,, 5 11	4 8 ,, 5 8
New Zealand, Frozen... ...	3 2 ,, 3 5	3 1 ,, 3 5	3 4 ,, 3 8	3 4 ,, 3 7
VEAL :—				
Best	4 8 ,, 5 2	4 6 ,, 5 0	4 4 ,, 4 11	4 7 ,, 5 0
Secondary and middling ...	3 9 ,, 4 6	3 9 ,, 4 5	3 6 ,, 4 2	3 9 ,, 4 4
PORK :—				
English, best	3 10 ,, 4 2	3 6 ,, 3 11	3 6 ,, 3 10	3 8 ,, 4 0
,, seconds and thirds ...	3 3 ,, 3 7	3 0 ,, 3 4	3 0 ,, 3 4	3 2 ,, 3 6

AVERAGE WHOLESALE PRICES of CATTLE and SHEEP, per 8 lb., *sinking the offal*, at the METROPOLITAN CATTLE MARKET, during the under-mentioned Quarters of 1902 and 1903.

PERIOD.	CATTLE.			SHEEP.		
	Inferior.	Second.	First.	Inferior.	Second.	First.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
2nd Quarter, 1902	3 3	4 6	5 1	3 10	5 2	6 0
3rd Quarter, ,,	3 1	4 7	5 1	3 8	5 0	5 9
4th Quarter, ,,	2 9	4 4	5 1	3 6	5 0	5 11
1st Quarter, 1903	3 2	4 5	4 11	3 8	5 5	6 2
2nd Quarter, ,,	2 9	4 0	4 7	3 8	5 1	5 9

AVERAGE WHOLESALE PRICES of BEEF and MUTTON, per 8 lb., by the Carcase, at LIVERPOOL and GLASGOW, during the under-mentioned Quarters of 1902 and 1903.

PERIOD.	LIVERPOOL.*		GLASGOW.†	
	BEEF.	MUTTON.	BEEF.	MUTTON.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
2nd Quarter, 1902	3 4 to 4 8	3 6 to 5 6	4 4 to 5 8	4 4 to 6 8
3rd Quarter, ,,	2 8 ,, 4 8	3 4 ,, 5 0	4 2 ,, 5 6	4 0 ,, 5 8
4th Quarter, ,,	2 8 ,, 4 4	3 4 ,, 5 2	3 8 ,, 5 0	4 4 ,, 5 8
1st Quarter, 1903	2 8 ,, 4 2	4 0 ,, 6 0	3 8 ,, 4 10	5 0 ,, 6 4
2nd Quarter, ,,	2 10 ,, 4 2	4 0 ,, 5 10	4 2 ,, 4 8	5 4 ,, 6 8

* Compiled from information furnished by the Medical Officer of Health, Liverpool. The prices quoted are for Carcases of Animals *slaughtered at the Liverpool Abattoir*, and do not apply to Imported Meat.

† Compiled from information furnished by the Principal of the Veterinary College, Glasgow.

BERLIN MARKET.

AVERAGE PRICES of CATTLE, SHEEP, and SWINE (Dead Weight) in the BERLIN CATTLE MARKET in the under-mentioned Months of 1903.

MONTHS.	OXEN.	SHEEP.	SWINE.
	Per Cwt.	Per Cwt.	Per Cwt.
1903.	s. d.	s. d.	s. d.
May	61 2	63 9	47 4
June	64 11	67 2	47 1
July	—	—	—

NOTE.—The above prices are compiled from the Wholesale Prices quoted in the *Monatliche Nachweise über den auswärtigen Handel des deutschen Zollgebiets.* The prices for swine are live weight prices with 20 per cent. tare.

PARIS MARKET.

AVERAGE PRICES of CATTLE, SHEEP, and SWINE (Medium Quality, Dead Weight), per cwt., in the PARIS CATTLE MARKET in the under-mentioned Months of 1903.

MONTHS.	OXEN.	CALVES.	SHEEP.	PIGS.
	Per Cwt.	Per Cwt.	Per Cwt.	Per Cwt.
1903.	s. d.	s. d.	s. d.	s. d.
June	54 7	64 4	77 9	56 2
July	55 0	62 1	78 5	61 7
August	57 5	60 3	80 3	61 1

NOTE.—The above prices have been compiled from the weekly returns published in the *Journal d'Agriculture Pratique.*

CHICAGO.

AVERAGE PRICES of CATTLE at CHICAGO per cwt. (Live Weight) in the under-mentioned Months of 1903.

MONTH.	Medium to Good.					Good to Choice.					Choice to Extra Prime.				
	s.	d.		s.	d.	s.	d.		s.	d.	s.	d.		s.	d.
June	21	10	to	23	2	23	2	to	24	9	24	10	to	26	8
July	22	0	,,	23	3	23	3	,,	24	10	24	10	,,	26	7
August	22	0	,,	23	8	24	0	,,	25	8	26	1	,,	27	1

Compiled from the Live Stock Reports issued by Messrs. Clay, Robinson and Co., of the Union Stock Yards, Chicago, Illinois.

AVERAGE VALUES, per cwt., of various Kinds of DEAD MEAT Imported into the United Kingdom from FOREIGN COUNTRIES and BRITISH POSSESSIONS in the under-mentioned Quarters of 1902 and 1903.

(Computed from the Trade and Navigation Accounts.)

PERIOD.	BEEF.				MUTTON.		PORK.				BACON.		HAMS.	
	Fresh.		Salted.		Fresh.		Fresh.		Salted.					
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
2nd Quarter, 1902...	43	6	31	4	38	1	44	11	28	10	51	3	50	0
3rd Quarter, ,, ...	43	10	33	2	38	5	44	2	28	4	55	8	54	9
4th Quarter, ,, ...	42	11	34	6	39	7	44	9	31	0	56	10	55	8
1st Quarter, 1903...	41	9	34	3	39	8	44	8	31	0	52	9	54	0
2nd Quarter, ,, ...	41	6	28	11	39	9	43	8	26	6	53	4	54	9

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels,* computed from the Weekly Averages of Corn Returns from the Returning Markets of ENGLAND AND WALES, pursuant to the Corn Returns Act, 1882, together *with the* QUANTITIES returned as sold at such Markets, in the under-noted periods of the Years 1903, 1902, and 1901.

QUARTER ENDED	PRICES.			QUANTITIES.		
	1903.	1902.	1901.	1903.	1902.	1901.
			Wheat.			
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	25 2	27 3	26 3	694,912	826,066	744,018
Midsummer ...	26 11	29 10	27 1	639,441	444,639	547,737
Michaelmas ...	—	30 2	26 11	—	222,495	535,109
Christmas ...	—	25 0	26 7	—	754,737	778,686
			Barley.			
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	23 5	26 8	25 3	975,720	669,251	844,616
Midsummer ...	22 2	25 6	24 9	98,961	40,875	53,408
Michaelmas ...	—	25 1	24 0	—	32,318	236,164
Christmas ...	—	25 5	26 8	—	2,040,980	2,235,441
			Oats.			
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	16 11	20 3	17 6	372,119	239,048	236,316
Midsummer ...	18 0	22 1	19 3	188,528	88,274	81,172
Michaelmas ...	—	21 3	18 7	—	101,130	131,023
Christmas ...	—	17 0	18 4	—	402,833	265,703

* Section 8 of the Corn Returns Act, 1882, provides that where returns of purchases of British Corn are made to the local inspector of Corn Returns in any other measure than the imperial bushel or by weight or by a weighed measure, that officer shall convert such returns into the imperial bushel, and in the case of weight or weighed measure the conversion is to be made at the rate of 60 imperial pounds for every bushel of wheat, 50 imperial pounds for every bushel of barley, and 39 imperial pounds for every bushel of oats.

CORN PRICES:—HARVEST YEAR.

AVERAGE PRICES of **British Corn** per Quarter of 8 imperial bushels, computed from the Weekly Averages of Corn Returns, together *with the* QUANTITIES returned as sold at the Returning Markets during each of the Harvest Years ending 31st August, 1890 to 1903.

HARVEST YEARS.	PRICES.			QUANTITIES.		
	Wheat.	Barley.	Oats.	Wheat.	Barley.	Oats.
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
1889-90 ...	31 2	28 10	18 6	3,289,806	3,281,141	558,053
1890 91 ...	35 5	28 0	19 1	3,496,788	3,659.382	602,887
1891-92 ...	33 4	27 2	20 8	3,267,038	3,260,327	488,830
1892-93 ...	26 8	24 10	18 9	2,676,227	3,383,094	547,412
1893-94 ...	25 5	26 5	18 4	2,087,062	2,876,977	542.425
1894-95 ...	21 5	21 5	14 8	2,180,959	3,136.415	693,121
1895-96 ...	24 10	22 4	14 1	1,640,943	3,366,364	672,547
1896-97 ...	28 8	23 2	16 9	2,597,268	3,200.612	551,912
1897-98 ...	36 2	26 11	18 3	2.534 224	3 339.842	599,666
1898-99 ...	26 0	26 1	17 3	3.498,515	3,629,760	777,676
1899-00 ...	26 4	25 2	17 4	3 255,654	3,355.241	722,859
1900-01 ...	27 1	25 0	18 1	2,463,341	3,109,149	684,956
1901-02 ...	28 4	25 11	20 4	2,451,275	3,176,599	698,840
1902-03 ...	26 5	23 4	17 8	2,386,017	3,151.337	1,104,660

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, *computed from the Returns received under the* Corn Returns Act, 1882, in each of the under-mentioned Weeks in 1903, and in the corresponding Weeks in 1902 and 1901.

Weeks ended (*in* 1903).	**Wheat.**						**Barley.**						**Oats.**					
	1903.		1902.		1901.		1903.		1902.		1901.		1903.		1902.		1901.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 3 ...	25	0	27	7	26	5	23	11	26	7	25	4	16	10	19	10	17	2
,, 10 ...	24	11	27	8	26	7	24	1	26	7	25	6	17	0	20	0	17	3
,, 17 ...	24	11	27	8	26	11	24	1	26	11	25	9	16	10	20	0	17	3
,, 24 ...	25	0	27	7	26	10	24	1	26	7	25	6	16	11	20	3	17	6
,, 31 ...	25	4	27	4	26	7	24	3	26	7	25	7	17	0	20	2	17	8
Feb. 7 ...	25	6	27	2	26	8	23	9	26	9	25	7	16	11	20	3	17	7
,, 14 ...	25	6	26	11	26	4	23	7	27	5	25	4	17	1	20	3	17	7
,, 21 ...	25	4	27	1	26	1	23	4	26	11	25	0	17	1	20	4	17	7
,, 28 ...	25	3	27	1	25	11	23	2	26	8	25	0	17	1	20	5	17	9
Mar. 7 ...	25	3	27	0	25	9	23	1	26	8	25	4	17	1	20	5	17	7
,, 14 ...	25	1	27	1	25	9	22	10	26	6	25	1	17	0	20	6	17	7
,, 21 ...	25	1	27	1	25	8	22	9	26	4	24	11	16	10	20	6	17	9
,, 28 ...	25	2	27	2	26	0	22	4	27	2	24	9	17	0	20	7	18	0
Apl. 4 ...	25	3	27	3	26	3	22	6	26	5	25	3	17	0	20	6	18	0
,, 11 ...	25	4	27	5	26	5	21	10	26	7	26	0	17	2	21	0	18	1
,, 18 ...	25	6	27	7	26	8	21	6	27	1	25	7	17	3	21	1	18	8
,, 25 ...	26	1	28	9	26	8	21	9	26	5	25	8	17	9	21	6	18	8
May 2 ...	26	10	29	9	26	9	22	1	27	5	26	4	18	0	21	10	19	1
,, 9 ...	27	6	30	9	27	3	21	10	26	10	26	2	18	2	22	6	19	1
,, 16 ...	27	9	31	1	27	7	22	5	25	3	24	2	18	4	22	5	19	4
,, 23 ...	27	10	31	6	27	7	23	7	25	4	24	1	18	5	22	6	19	8
,, 30 ...	27	8	31	6	27	7	23	7	25	1	23	8	18	5	22	10	19	9
June 6 ...	27	6	31	3	27	6	23	10	24	3	22	9	18	4	22	11	20	1
,, 13 ...	27	8	30	11	27	8	21	5	23	8	24	0	18	7	22	8	19	7
,, 20 ...	27	6	30	6	27	6	20	7	23	5	23	2	18	3	23	0	20	3
,, 27 ...	27	6	30	5	27	6	22	0	24	3	25	4	18	6	22	9	20	0
July 4 ...	27	9	30	8	27	8	20	7	25	5	21	9	18	6	22	5	19	10
,, 11 ...	28	1	30	10	27	2	19	11	24	8	23	10	18	3	22	10	19	9
,, 18 ...	28	3	30	11	27	3	20	5	23	8	23	4	18	7	22	10	19	11
,, 25 ...	28	7	31	5	27	3	20	10	25	0	22	1	18	5	22	8	19	4
Aug. 1 ...	28	11	31	8	27	6	21	0	25	0	23	1	18	6	22	10	20	0
,, 8 ...	29	3	31	7	27	7	20	1	24	11	22	1	18	8	22	11	19	4
,, 15 ...	29	11	31	7	27	4	21	3	24	9	27	2	18	10	22	2	18	9
,, 22 ...	29	9	31	5	27	3	20	4	22	10	23	7	18	6	21	11	18	1
,, 29 ...	30	0	31	7	27	0	22	3	26	2	24	3	18	7	21	0	17	10
Sept. 5 ...	30	3	29	9	26	5	22	5	24	6	25	1	18	5	19	10	17	6
,, 12 ...	28	6	27	10	26	2	22	4	27	5	24	11	17	0	19	2	17	4
,, 19 ...			27	1	26	0			26	4	25	5			18	4	17	4
,, 26 ...			26	6	25	10			26	4	25	10			18	0	17	2
Oct. 3 ...			25	10	25	8			25	11	26	3			17	5	17	7
,, 10 ...			25	5	25	9			26	2	26	5			17	2	17	6
,, 17 ...			25	1	25	10			26	1	26	8			17	0	17	8
,, 24 ...			24	11	25	11			26	4	26	10			17	0	17	5
,, 31 ...			25	0	26	2			26	7	26	10			17	3	17	7
Nov. 7 ...			25	1	26	6			26	3	27	0			17	2	17	8
,, 14 ...			25	0	26	9			25	11	26	9			17	3	18	3
,, 21 ...			24	11	27	1			25	6	26	10			17	2	18	7
,, 28 ...			25	0	27	1			24	11	26	9			17	0	18	9
Dec. 5 ...			25	1	27	1			24	4	26	7			17	0	19	0
,, 12 ...			25	0	27	2			24	3	26	8			16	10	19	3
,, 19 ...			24	10	27	7			24	2	26	8			16	10	19	8
,, 26 ...			24	10	27	7			24	1	26	8			16	8	19	10

AVERAGE PRICES of WHEAT, BARLEY, and OATS, per IMPERIAL QUARTER in BELGIUM in the under-mentioned Months of 1903.

Month.	Wheat.		Barley.		Oats.	
1903.	s.	d.	s.	d.	s.	d.
May	28	10	22	2	17	7
June	29	9	21	10	17	10
July	29	11	21	11	18	1

The above prices have been compiled from the official monthly averages published in the *Moniteur Belge*.

AVERAGE PRICES of WHEAT, BARLEY, and OATS, per IMPERIAL QUARTER in FRANCE, and ENGLAND and WALES, in the under-mentioned Months of 1903.

MONTH.	FRANCE.		ENGLAND.	
WHEAT.				
1903.	Per Qr. s.	d.	Per Qr. s.	d.
June	41	3	27	6
July	40	11	28	2
August	38	11	29	6
BARLEY.				
1903.	Per Qr. s.	d.	Per Qr. s.	d.
June	24	2	21	11
July	24	1	20	5
August	23	4	20	11
OATS.				
1903.	Per Qr. s.	d.	Per Qr. s.	d.
June	19	3	18	5
July	18	10	18	5
August	18	0	18	7

NOTE.—The prices of French grain have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*. The prices of British grain are official averages based on the weekly returns furnished under the Corn Returns Act, 1882.

AVERAGE PRICES of WHEAT, BARLEY, and OATS per IMPERIAL QUARTER at LONDON, PARIS, and BERLIN, in the under-mentioned Months of 1903.

Month.	London.		Paris.		Berlin.	
			WHEAT.			
	Per Qr.		Per Qr.		Per Qr.	
	s.	d.	s.	d.	s.	d.
May, 1903	28	1	42	8	36	1
June „	28	0	42	7	36	3
July „	27	8	42	9	—	
August „	29	6	40	0	—	
			BARLEY.			
	Per Qr.		Per Qr.		Per Qr.	
	s.	d.	s.	d.	s.	d.
May, 1903	20	6	24	9	23	4*
June „	21	7	24	9	23	2*
July „	21	4	24	5	—	
August „	21	4	23	10	—	
			OATS.			
	Per Qr.		Per Qr.		Per Qr.	
	s.	d.	s.	d.	s.	d.
May, 1903	18	11	18	9	18	2
June „	18	11	19	0	19	7
July „	19	3	18	11	—	
August „	19	0	18	4	—	

NOTE.—The London quotations represent the price of British corn as returned under the Corn Returns Act, 1882; the prices of grain in Paris have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique*; the quotations for Berlin are the average prices published monthly in the *Monatliche Nachweise über den auswärtigen Handel des deutschen Zollgebiets*.

* Prices at Breslau; no quotations for Berlin.

PRICES OF WOOL.

AVERAGE PRICES of ENGLISH WOOL, per pack of 240 lb., *in the under-mentioned Months of 1903.*

(*Compiled from the "Economist."*)

DESCRIPTION.	June.	July.	August.
	£ s. d. £ s. d	£ s. d. £ s. d.	£ s. d. £ s. d.
South Down ...	8 10 0 to 11 10 0	8 10 0 to 11 10 0	8 10 0 to 11 10 0
Half-breds ...	6 5 0 „ 7 7 6	7 7 6 „ 8 2 6	7 10 0 „ 8 5 0
Leicester ...	6 1 3 „ 6 6 3	6 5 0 „ 6 10 0	6 5 0 „ 6 10 0
Kent Fleeces ...	6 10 0 „ 7 2 6	6 17 6 „ 7 10 0	6 18 0 „ 7 8 0

AVERAGE WHOLESALE PRICES of BUTTER, MARGARINE, and CHEESE in the under-mentioned Months of 1903.

(*Compiled from the "Grocer."*)

DESCRIPTION.	JUNE.				JULY.				AUGUST.			
BUTTER :	Per Cwt.*				Per Cwt.*				Per Cwt.*			
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
Cork, 1sts	84	6 to	—		84	6 to	—		83	6 to	—	
,, 2nds	82	9 ,,	—		81	3 ,,	—		80	3 ,,	—	
,, 3rds	79	6 ,,	—		79	0 ,,	—		76	6 ,,	—	
,, 4ths	73	9 ,,	—		74	9 ,,	—		73	6 ,,	—	
Irish Creameries ...	91	0 ,,	97	9	91	6 ,,	96	6	91	6 ,,	98	9
,, Factories ...	81	6 ,,	88	6	81	0 ,,	88	6	81	3 ,,	90	0
Dutch, Friesland ...	—				—				—			
,, Creameries ...	91	0 ,,	94	6	90	6 ,,	94	6	94	0 ,,	98	0
,, Rolls, boxes ...	11	0 ,,	11	6	11	0 ,,	11	6	11	0 ,,	11	6
French, extra mild ...	94	6 ,,	97	0	90	0 ,,	94	0	90	0 ,,	93	3
,, best ordinary ...	88	6 ,,	92	6	86	0 ,,	88	0	85	6 ,,	87	6
,, 2nds and inferior ...	78	6 ,,	84	6	71	6 ,,	84	0	68	6 ,,	83	3
,, Fresh, Paris baskets	94	9 ,,	98	9	91	0 ,,	95	0	91	0 ,,	95	0
,, Rolls, per doz. ...	9	4 ,,	12	4	9	0 ,,	12	0	9	0 ,,	12	0
Italian Rolls, per doz.	9	10 ,,	11	10	10	0 ,,	12	0	10	0 ,,	12	0
Danish and Swedish ...	99	6 ,,	102	3	100	0 ,,	103	0	102	6 ,,	104	6
Russian and Siberian ...	80	0 ,,	88	0	71	6 ,,	85	6	68	9 ,,	86	0
Argentine	84	0 ,,	93	0	86	0 ,,	94	0	87	6 ,,	94	9
Colonial, fine	89	6 ,,	95	0	86	0 ,,	94	0	94	6 ,,	98	0
,, good and inferior	74	0 ,,	86	0	74	0 ,,	84	0	—			
Canadian Creameries ...	88	0 ,,	92	0	86	0 ,,	92	6	86	0 ,,	96	0
,, Dairies	—				—				76	0 ,,	84	0
MARGARINE	32	0 ,,	50	0	30	6 ,,	47	0	30	0 ,,	46	0
CHEESE, ENGLISH : Cheddar, ...	69	0 ,,	75	6	62	6 ,,	68	0	58	9 ,,	69	3
,, loaf	72	0 ,,	74	0	65	0 ,,	68	0	66	0 ,,	68	0
Wiltshire ,, ...	—				72	0 ,,	—		72	0 ,,	—	
Derby Factory... ...	—				57	0 ,,	60	0	58	6 ,,	60	6
Double Gloucester ...	—				—				66	0 ,,	68	0

* Except where otherwise stated.

WEEKLY PRICES (WHOLESALE) of VEGETABLES and FRUIT at COVENT GARDEN in each week of August, 1903.

(Compiled from the "Gardeners' Chronicle.")

Description.	Week ending August 6th.		August 13th.		August 20th.		August 27th.	
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
VEGETABLES—								
Artichokes, Globe, per dozen	1 0	1 6	0 6	1 0	2 0	3 0	1 6	—
Beans, Broad, bushel	1 6	2 0	1 0	1 6	0 9	1 0	0 9	1 0
,, Scarlets, sieve	4 0	5 0	1 6	2 0	*4 6	7 0	*4 0	5 0
Beetroots, per dozen	2 0	3 0	2 0	3 0	2 0	3 0	*2 0	2 6
Cabbage, per tally	3 0	5 0	3 0	5 0	3 0	5 0	3 0	5 0
Carrots, new, per doz. bunches	1 0	1 3	0 9	1 0	0 9	1 3	0 9	1 3
Cauliflowers, per doz.	2 6	3 0	2 0	3 0	3 0	4 0	2 0	2 6
Celery, per doz. bndls.	9 0	10 0	9 0	10 0	8 0	10 0	10 0	15 0
Cress, per doz. punnets	1 3	—	1 3	—	1 3	—	1 3	—
Cucumbers, per doz.	1 6	3 0	1 6	2 6	1 6	2 3	1 0	2 0
Endive, per dozen	1 6	—	1 6	—	1 6	—	1 6	—
Leeks, per doz. bnchs.	1 6	2 0	1 6	2 0	1 6	2 0	1 0	1 6
Lettuces cabbage, doz.	0 9	1 0	0 6	0 9	0 6	0 9	0 6	0 9
,, cos, per score	0 6	1 6	0 6	1 6	0 6	1 6	1 0	—
Marrows, Vegetable, per dozen	1 0	1 6	0 9	1 0	†1 6	2 6	†2 6	4 0
Mint, per doz. bunches	2 0	2 6	2 0	2 6	1 0	2 0	1 0	1 6
Mushrooms, House, lb.	0 8	1 0	0 8	0 9	0 10	1 0	0 10	1 0
Onions, green, dozen bunches	1 6	2 6	1 6	2 6	2 0	2 6	1 6	2 0
Onions, per case	5 0	—	4 0	5 0	4 0	5 0	4 0	5 0
Parsley, doz. bunches	2 0	3 0	1 6	2 0	1 0	1 6	1 0	1 6
Peas, per bushel	2 6	3 6	3 6	4 0	3 0	4 6	3 0	4 0
,, per bag	4 0	7 0	3 0	6 0	4 0	7 0	4 0	6 0
Potatoes, per ton	60 0	120 0	70 0	100 0	60 0	100 0	60 0	100 0
Radishes, doz. bunches	0 9	1 0	0 6	0 9	0 6	0 9	0 6	0 9
Salad, small, per doz. punnets	1 3	—	1 3	—	1 3	—	1 3	—
Spinach, per sieve	2 0	2 6	1 3	1 6	1 3	1 6	1 0	1 3
Tomatoes, English, per doz. lbs.	3 6	4 6	2 0	3 0	2 0	3 0	3 6	4 6
Tomatoes, Channel Islands, per lb.	0 3	0 4	0 2	0 2¼	0 2	0 2¼	0 3¼	0 4
Turnips, new, per doz. bunches	2 0	3 0	2 0	3 0	2 0	3 0	2 0	3 0
Watercress, doz. bnchs.	0 4	0 6	0 4	0 6	0 4	0 6	0 4	0 6
FRUIT—								
Apples, English, per half bushel	3 6	7 6	3 0	8 0	2 6	4 0	2 6	3 6
Cherries, per sieve	6 0	10 0	—	—	—	—	—	—
Currants, Red, sieve	5 0	5 6	5 0	6 0	—	—	—	—
,, Black, sieve	12 0	—	12 0	—	—	—	—	—
Gooseberries, per sieve or half bushel	4 0	—	4 0	—	—	—	—	—
Grapes, Alicante, lb.	0 10	1 6	0 10	1 6	0 8	1 4	0 8	1 4
,, Gros Maroc, lb.	1 0	1 6	1 0	1 6	1 0	1 6	1 0	1 6
,, Muscat, lb.	1 0	4 0	1 0	3 6	1 0	3 0	0 8	3 0
,, New H'mburg, per lb.	0 8	2 0	0 8	2 0	0 8	2 0	0 6	1 6
Peaches, per doz.	1 0	12 0	1 0	12 0	1 6	12 0	1 6	12 0
Plums, per sieve	7 0	11 0	7 0	11 0	6 0	10 0	3 0	10 0
Raspberries, per doz. punnets	6 0	—	6 0	—	—	—	—	—
Raspberries, per cwt.	42 0	—	—	—	—	—	—	—

* Per bushel. † Per tally.

DISEASES OF ANIMALS ACTS, 1894 to 1903.

NUMBER of OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture.)

Disease.	Quarter Ended.		Half-Year Ended.	
	June, 1903.	June, 1902.	June, 1903.	June, 1902.
Foot-and-Mouth Disease :—				
Outbreaks	—	—	—	1
Animals attacked	—	90	—	120
Swine-Fever :—				
Outbreaks	526	469	879	868
Swine Slaughtered as diseased or exposed to infection ...	2,557	1,976	4,191	4,098
Rabies :—				
Number of Cases :—				
Dogs	—	4	—	12
Other Animals	—	2	—	2
Anthrax :—				
Outbreaks	225	175	429	377
Animals attacked	346	268	669	625
Glanders (including Farcy) :—				
Outbreaks	380	278	683	563
Animals attacked	597	489	1,135	1,032
Sheep-Scab :—				
Outbreaks	112	132	1,065	1,043
Animals attacked	2,580	1,797	12,644	12,445

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction in Ireland.)

Disease.	Quarter Ended.		Half-Year Ended.	
	June, 1903.	June, 1902.	June, 1903.	June, 1902.
Swine-Fever :—				
Outbreaks	50	53	64	89
Swine Slaughtered as diseased or exposed to infection ...	1,157	1,167	1,564	1,811
Anthrax :—				
Outbreaks	2	—	2	—
Animals attacked	3	—	3	—
Glanders (including Farcy) :—				
Outbreaks	—	2	1	6
Animals attacked	—	8	2	21
Sheep-Scab :—				
Outbreaks	60	68	391	431

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County Maps for Great Britain*	**1s. 0d.**
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LIST OF LEAFLETS ISSUED BY THE BOARD OF AGRICULTURE.

(*a.*) *Leaflets dealing with Insects and Fungi injurious to Crops.*

No.	Title.	No.	Title.
1	Black Currant Mite.	46	Stem Eelworm.
2	Vine, Plum, Hop and Raspberry Weevils.	47	Asparagus Beetle.
3	Turnip Fly or Flea.	48	Pea and Bean Thrips.
4	Caterpillars on Fruit Trees.	49	Fruit Tree Beetle.
5	Mangold Fly.	52	Gooseberry Mildew.
10	Wireworms.	53	Pear Midge.
11	Daddy Longlegs or Crane Fly.	56	Canker Fungus.
12	Gooseberry Saw Fly.	60	Wood Leopard Moth.
14	Raspberry Moth.	62	Pear and Cherry Saw Fly
15	Apple Blossom Weevil	64	White Root Rot.
16	Apple Sucker.	65	Small Ermine Moths.
19	Pea and Bean Weevils.	68	Currant Aphides.
20	The Magpie Moth.	69	Tent Caterpillars.
22	Diamond-back Moth.	70	Winter Washing of Fruit Trees.
23	Potato Disease.	75	Root-knot Eelworm in Cucumbers and Tomatoes.
24	Ribbon Footed Corn Fly.	76	Cucumber and Melon Leaf Blotch.
25	Chafer-beetles or White-Grubs.	77	Finger-and-Toe in Turnips.
30	Codlin Moth.	86	Brown Rot of Fruit.
31	Onion Fly.	87	Fungus Disease of Young Fruit Trees.
33	Surface Caterpillars.	88	Hop Aphis.
34	Woolly Aphis or Apple Root Louse.	90	Pith Moth.
35	Celery Fly.	91	Pine Beetle.
38	Carrot Fly.	92	Bunt and Smut.
41	Red Spider.		

(*b.*) *Leaflets dealing with Wild Birds.*

40	Kestrel or Wind-hover.	50	Water Wagtails or "Dishwashers."
42	Short-Eared Owl.	51	White or Barn Owl.
43	Titmice.	54	Spotted Flycatcher.
44	Common Lapwing, Plover or Peewit.	55	Swallow.
45	Starling.	84	House Sparrow.

(*c.*) *Leaflets dealing with Animals, including Poultry.*

13	Acorn Poisoning.	67	Favus in Poultry.
21	Warble Fly.	78	Liver Disease of Poultry.
28	Anthrax.	81	A Substitute for Dishorning.
29	Swine Fever.	82	Preparation of Wool for Market.
57	External Parasites of Poultry.	83	Preservation of Eggs.
58	Internal Parasites of Poultry.	89	Rot in Sheep.
61	Sheep Scab.		

(*d.*) *Leaflets relating to Acts of Parliament.*

8	Farmers and Assessments to Local Rates.	27	Remission of Tithe Rentcharge.
18	Fertilisers and Feeding Stuffs Act.	39	Assessment to Land Tax.
26	Farmers and the Income Tax.	66	Workmen's Compensation Act, 1900.

(*e.*) *Leaflets dealing with Miscellaneous Subjects.*

6	Voles and their Enemies.	73	Cultivation of Maize for Fodder.
9	Ensilage.	74	Purchase of Feeding Stuffs.
32	Foul Brood or Bee Pest.	79	Rations for Farm Stock.
36	Cultivation of Osiers.	80	Use of Artificial Manures.
63	Destruction of Charlock.	85	Haymaking.
72	Purchase of Artificial Manures.	93	Farmyard Manure.

The issue of Leaflets 7, 17, 18, 37, 59 and 71 is suspended.

Copies of these Leaflets may be obtained free of charge and post free on application to the Secretary, Board of Agriculture, 4, Whitehall Place, London, S.W. Letters of application so addressed need not be stamped.

THE JOURNAL

OF THE

BOARD OF AGRICULTURE.

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PLOUGHS AND PLOUGHING.

In ancient times, and even up till within the memory of people still living, the plough consisted simply of the crooked branch of a tree: the horse was yoked to one end, the man held the other, while a projecting middle part—sharpened to a point—formed a sort of grubber which was forcibly dragged through the soil, making a rut in which the seed was deposited. The covering of the wearing parts with plates of iron, the fitting on of a cutting-knife or coulter in front, and the forming of a twist on the wrest or mouldboard, whereby the soil could be turned or inverted, came later on; while the iron plough was in many cases only introduced at the beginning of the nineteenth century. Even now, at the commencement of the twentieth century and within twenty miles of London, the wooden plough still obtains, and farmers are only beginning to hear of the iron plough—so great is the conservatism of a certain type of mind, and so little will some farmers try to move with the times or improve the methods of their grandfathers.

The modern iron swing plough was first evolved in Holland, and introduced into Great Britain about 150 years ago under the name of the Dutch or Rotherham plough; later on, Small and Wilkie took the matter up and developed two forms, each famous in their day—the East Lothian and the Lanarkshire—which became the types for the greater part of the country until the present generation, when the introduction of the chilled steel plough from America upset all our ideas on the

matter and quite revolutionised the style of work in the most go-ahead districts.

Mechanical Laws.

Before going any further it is perhaps desirable to explain some of the mechanical laws which govern the action and use of a machine, however simple; and how these affect the construction and use of the plough. Looked at in its simplest form the plough is a combination of the wedge and the lever: the "body" of the plough is the wedge which splits off the furrow-slice from the solid "land," while the handles or stilts act as a lever for moving this wedge up, down, or sideways.

Taking the handles first: as the longer the arm of a lever is the more powerful will it be, and the more easily will any given body be moved by it, so therefore the longer the handles of a plough are the more comfortably will the ploughman hold his tool. On the other hand, if they are too long he has less control of his horses, longer reins will be needed, and a greater arc walked round while turning at the land-ends, and the headlands also must be wider. The extreme length the writer has seen and handled on a plough was on one exhibited by the Ballarat Agricultural Society at the Colonial Exhibition in London in 1886, on which the handles or stilts measured 10 feet from points to heel of body. Practical experience in this country has shown, however, that the most convenient length consistent with power is about 6 feet. In many foreign forms, especially those introduced from America, the handles are very much less than this—not much over 3 feet—and it is rather a puzzle to understand how they are held with any comfort. On the fluffy black soil of the prairies, however, as on some of our sandy and peaty soils at home, almost any kind of plough will work somehow. The writer has had an opportunity of trying these ploughs practically both in America and at home, and has found that the plough with short handles, which can be held quite easily in the loam of the prairie, is an absolute failure on the clay of Essex, thus vindicating the correctness of the laws of the lever. This fault has been so glaring in the case of ploughs imported to this country from the United States and Canada that many of the

makers have now adopted long handles on their chilled steel implements for use in this country—even on wheel ploughs.

Draught.

The mechanical principles involved in the draught of the ordinary plough control the arrangement and position of the parts very much. The centre of draught—*i.e.*, the point from which the horses are in effect pulling—is situated behind the heel of the share, about 2 inches above the sole-plate or level of the bottom of the furrow, and 2 inches from the cheek-plate (side-cap) or land side. Round this point the various forces or resistances due to the turning furrow-slice, the cutting action of the coulter, the wedge action of the share, and the pressure of the solid ground on the land side, are balanced. It is not a fixed point, but varies according to the kind of plough, the depth and width of the furrow-slice, and even varies as the plough moves along when it meets an obstruction like a stone or a stiff piece of soil, or when the ploughman swings the handles one way or another. When the implement is properly "tempered," however, it always tends to right itself, so that the line of draught will come back to the one point for that particular set of the "irons" or special kind of plough. As this "centre of resistance" is underground when the implement is at work it is impossible to attach the horses directly to it, and therefore the arrangement of the beam or other framework comes into play, whereby the horses can have a point of attachment above ground. For a swing plough the beam should be as short as permissible, so that the horses shall have as little leverage power as possible acting against the leverage power of the man behind when holding the stilts; but in a wheel plough it may be longer—partly to give room for the wheels and partly because these will take up and carry any irregular draught on the part of the horses. The line of draught passes from the shoulder-hooks on the horses' hames to the "centre of resistance" above described in the body of the plough. It must pass through the point of attachment at the end of the beam, so therefore there is here affixed a bridle, head, muzzle, hake or clevis (as it is variously called), whereby this point may be moved up or down or sideways by means of

pins or notches or other arrangement, so that the point of attachment may be brought accurately into line with the line of draught. The adjustment of the bridle needs the constant attention of the ploughman quite as much as the setting of the cutting-irons, as any change in the plough—such as taking a different size of furrow-slice, substituting small horses for large ones, putting in fresh cutting-irons for worn and blunt ones, &c.—necessitates the moving of the bridle-pin right or left to give more or less "land," or up or down to give more or less "earth."

The mechanical principles just mentioned involved in the draught of the plough can be best explained by a diagram. In giving a graphic representation of the effect of the application of force to a body it is customary to employ the "parallelogram of forces," and this in the case of the plough is illustrated in Figure 1. The plough is intended to move along horizontally, but the power of the horses is

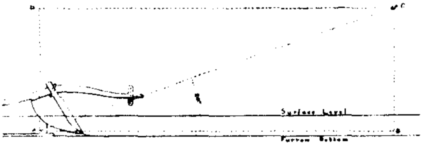


FIG. 1.—*Draught of the Plough.*

applied obliquely. The most convenient angle for the line of draught—*i.e.*, of the plough chains—has been found to be about 20 degrees with the ground line, and at this, with ordinary horses, the distance from the bridle-hook to the shoulder-hook on the hames will be about 10 feet. At these figures the line of draught will adjust itself correctly, the horses will pull comfortably, and the plough will swim through the soil with very little interference from the ploughman. But the oblique application of the force means that there is a loss of power—a loss which can be worked out mathematically. If the line of draught from the "centre of resistance," A in the diagram, to the shoulder-hook C be taken as the diagonal of a rectangular parallelogram, then if the parallelogram be completed the line AB will represent by its

length and direction the actual "useful" draught, and the perpendicular AD the direction and amount of the "lifting" power of the draught, the wasted power which has to be counteracted by giving the point of the share or the sole-plate or slade a slight dip downwards.

In the language of mechanics, the line AC is the "resultant" which can be divided into its "component forces" AB and AD, and by trigonometrical formulæ these can be calculated for any angle.

If we take the pull of the two horses at the maximum figure of 6 cwt. (672 lb.), and at the angle of 20 degrees, then :—

$$\begin{aligned} AB &= AC \cos 20 \\ &= 672 \times \cdot 93969 \\ &= 631 \cdot 47 \text{ lb.} \\ &= \text{actual draught of plough on level, in lb.} \end{aligned}$$

Again,

$$\begin{aligned} AD = BC &= AC \sin 20 \\ &= 672 \times \cdot 34202 \\ &= 229 \cdot 83 \text{ lb.} \\ &= \text{lifting pull on plough in lb.} \end{aligned}$$

This applied in practice means that the smaller the angle CAB the less will be the draught ; a steam plough, for instance, which is pulled horizontally, requires less power per cubic foot of earth moved than an ordinary horse-drawn one. On the other hand, by lengthening the plough-chains so as to reduce the angle of draught the draught itself is reduced, but, as above stated, practical experience has shown that about 10 feet from bridle-hook to hame-hook is the most convenient length. When the ground is very hard, however, as after harvest, and it is difficult to get the plough to cut into it, by lengthening the chain between the bridle and whipple-trees the direct pull is increased and the lifting pull lessened. Putting a chisel point on the share also helps its penetrating power, especially on stony land.

It will be noticed that the line AC is approximately at right angles to what will be the line of the hames, *i.e.*, the slope of the shoulder-blade of the horse—an arrangement to be aimed at. The shoulder-slope differs between different horses—being usually more upright in heavy work horses, for instance, than among driving or "hunter cattle"—while the angle of draught itself varies as between a plough or other tillage implement and

a wheeled implement like a cart; but the nearer the line of draught is at right angles to the line of the shoulder, the more comfortably will the horse work, and the less liability will there be to chafing or shoulder-slip.

The amount of the draught, measured in pounds or cwts. by a dynamometer, is a point of much interest. It varies very much according to the kind of plough, the nature of the soil, and, of course, the size of the furrow-slice. The extremes for an ordinary two-horse single plough are from about 2 cwt. up to 6 cwt. A modern plough with chilled steel wearing parts, and in light, sandy stubble land, can be pulled with a force of less than 2 cwt. as registered by a dynamometer, with a furrow of, say, 9 inches wide by 5 inches deep, this being equal to, say, 5 lb. per square inch of sectional area of furrow-slice. On the other hand, the writer has just been testing the plough he uses at present—a Canadian with chilled steel breast and two-wheeled —on a stubble after fallow on the Essex clay, and with a furrow-slice of 9 by 5 inches the draught is about 6 cwt., rising at times to 8, *i.e.*, at least 15 lb. per square inch of sectional area. This is, perhaps, the extreme of comfortable draught for even two powerful Clydesdale or Shire horses; more than this would necessitate the use of a third horse, as is the case on "three-horse land," for 3 cwt. per horse is about the limit for continuous work with an average animal.

The Mouldboard.

Within the last twenty years the greatest change has been in the fitting of the mouldboard itself. In the olden time this literally was a board, covered with iron to make it wear longer, while more recently it was made of cast iron from a carefully-made pattern, and our grandfathers, and even our fathers, procured the implement from their nearest blacksmith. The friction on these old rough cast iron wrests was fearful. The writer served his apprenticeship at the tail of one such arrangement, and well remembers how it took a week's ploughing of a loamy soil to put a smooth polished surface on it. The cast iron board is not yet banished—as he unfortunately knows, for prejudice dies hard among farmers and labourers—though it is now filed and ground to a smooth surface before being sent

out; but the modern one is a plate of chilled steel, the surface of which is as slippery as a sheet of ice, the difference in the draught, *i.e.*, in the friction, between the old and the new being something enormous. It is alleged that the particular brand of chilled cast steel of which these are made can only be produced in the anthracite regions of America, and that those of our home makers who try to imitate this style of make have to import their wrests ready made—as they cannot be made here—and fit them on to their own frames.

These steel breasts are made of two sheets put together, the outer one of the hardest chilled steel and the inner one of the mild and tough variety, the inner tough coating preventing the brittle outer skin from breaking.

The shape and comparative size of the mouldboard is a matter of great importance. In old times it was made as long as possible. The idea was to cut and turn over the furrow-slice gently, almost without cracking it, the resistance from friction being less on a long than on a short mouldboard set to the same width. As many men and some text-books have upheld the contrary of this latter statement, it is here necessary to make a digression to explain the laws of friction and of motion up an inclined plane as applied to a plough. The "body" of the plough, *i.e.*, the share, wrest, sole, cheek-plate, &c., forms a wedge, but a wedge consists of two inclined planes put together, so that the work of the plough resolves itself into passing a certain weight of earth (the furrow-slice) up a twisted inclined plane (the wrest). Now a long inclined plane, like a long, easy hill, does not require so much force to go up or to carry anything up as does a short steep one of the same perpendicular height. This means that in the plough the short, wide projecting wrest has a greater draught than a long one set to the same size of furrow; that is, the pressure on the short wrest is proportionally more than on the long one. Now the law of friction is that it varies as the pressure, and is independent of extent of surface, which is another way of saying that the friction on the short mouldboard is greater than that on the long one, and that therefore the longer it is the better. The longest the writer has ever seen was on the Ballarat plough above mentioned, where it was 5 feet, but in

ordinary practice from $2\frac{1}{2}$ to 3 feet is more common, and more easily handled, all things considered, while it is even as little as 18 inches on the modern chilled steel ploughs.

In favour of the friction on the short mouldboard, however, there is the fact that there is a less bulk of furrow-slice at any given moment passing up it than on the long one, but even after this is allowed for the draught on the long is less than on the short. In some of the trials which have been conducted the draught on these short ones has been found to be comparatively low, much lower than on the ordinary old-fashioned plough, but this is accounted for by the difference in the quality of the metal of which the breasts are made. Cast iron is nowhere, and even malleable steel is inferior in its friction-reducing power as compared with the cast chilled steel of the modern plough. There is no reason, of course, why a long breast should not be made of this latter material as well as a short one—and, if it were, the draught or friction would be found to be less than the other—but we have never happened to see a plough so made, while the short breast cultivates as well as ploughs.

In ploughing damp or wet clay one of the worst features to contend with is the stickiness or adhesiveness of the soil. This increases the friction and draught very much, for the furrow-slice tends to hold the plough by adhering to the wearing parts, and it is quite possible that in a case of this sort the short mouldboard has the advantage. In some clay districts it was the custom at one time to lubricate the breast as the furrow-slice slid up it by dropping water on it from a cistern set on the beam of the plough, but land requiring this sort of manipulation is much better in grass, and is probably out of cultivation now.

Apart from the question of friction, however, the short chilled steel mouldboard has shown itself the best, all things considered, as it leaves the land in a fitter state for putting a crop in and afterwards growing it, while doing the work much more quickly. It will not, of course, do ploughing-match work, but that is of little consequence, because it is a notorious fact that the style of ploughing which obtains prizes at a competition is not the best for the land, the crop, or the farmer's purse, and is such that many go-ahead farmers would not tolerate, for which

reasons ploughing matches are looked on with disfavour in some districts.

The Share.

One or two points about the share itself are interesting. A level-bottomed furrow is desirable, so that a good solid rectangular furrow-slice may be cut out. At one time, however—and in many cases even yet—it was customary to use a share with a high feather or wing, so that the slice was cut out deep at the land side and shallow at the other—giving a

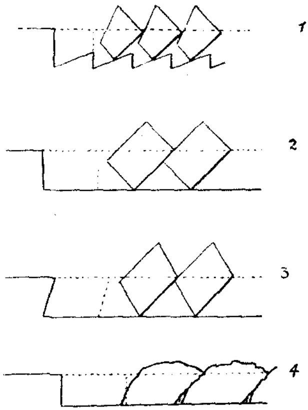


FIG. 2.—*Styles of Furrow-slice.*

trapezoidal section—showing a "crested" top when finished, but a "false" bottom and loose packing below. Nowadays, when we want "broken" work all over the surface, the modern shares are made with a level cutting edge of chilled steel, which scoops out the lot quite clean and makes work much better for the land and the crops than the old foolish method.

The four most typical styles of ploughing, which depend very largely on the shape and set of the share, are shown in Fig. 2. They are (1) Crested, (2) Rectangular, (3) Parallelogrammatic, and (4) Broken styles. The first, as has just been

mentioned, has always been objectionable; the second is the type which is largely followed with ordinary ploughs; while the last is the type now approved of as done by the various forms of chilled steel, digging, and disc ploughs. The ordinary rectangular form can be given all the advantages of "cresting," however, by setting the coulters at a small angle to the perpendicular (looked at edgeways), as shown in No. 3; but now, when we use corn drills and cultivate and harrow the ploughed land before sowing the seed, there is no advantage in cresting; breaking or crumpling up the soil, burying the surface rubbish completely, and getting over the ground quickly are the points to be aimed at.

Wheels.

One of the first and one of the greatest advances in the improvement of the plough was the application of wheels to it, whereby the depth and width of the furrow-slice could be regulated. Someone has said that the ancient Greeks used wheel ploughs, and Jethro Tull illustrates these in his work on *Husbandry* published in 1743, so that the idea is not quite new, but it is a peculiar fact that while wheeled ploughs have always been common in some parts of England, they were almost unknown in Scotland until quite recently. Indeed, Stephens, in his *Book of the Farm*, first published in 1842, blames English farmers for approving of their use, as tending to make the work too easy and encouraging laziness among the ploughmen and also increasing the draught to the horses. We have moved a long way forward since then, and now, whatever prejudice may exist in some districts against wheels—and there are some bad cases known to the writer—there is no gainsaying the fact that their modern adaptation is a decided advance in several ways. They keep the plough steadily at the one regular depth and width, so that when once set an inferior workman can do good work, and a skim-coulter acts with more regularity; they reduce the actual draught in exactly the same way that a wheeled carriage requires less draught than a sleigh; and they do away with the jerkiness so common with a swing plough in the hands of an inferior ploughman and so uncomfortable to the horses. Further, the adjustment of the line of draught does

not require to be so nice with a wheeled as with a swing plough, as the wheels carry the plough accurately at the one setting.

A great deal depends on the kind and arrangement of the wheels. The small single wheel below the beam is better than none at all, but it is of infinitely little use compared to the benefits to be derived from two wheels; while in the most modern forms—mostly American—there are three wheels fitted on, two in front and one behind. Further, these wheels are as large in diameter as possible, and narrow on the face of the rims. A broad-rimmed wheel is a mistake; on a sticky soil it clogs up with earth and is only a nuisance and holdback, while a scraper on each is absolutely necessary on such soils, though on sandy and loamy ground it may be dispensed with. With a wheel of the largest possible diameter, a narrow rim, and a scraper, the whole runs more smoothly and with less clogging, and the draught is lighter and the work easier.

On some ploughs, to obviate the clogging of the wheels on sticky land, it is customary to use a slide-foot—a piece of iron fastened to the beam with a part turned horizontally so as to slide along the surface of the ground, and thus give a gauge for the depth. It does not work so well as a wheel, however, and cannot take the place of two or three wheels.

The Skim-Coulter.

An important and indispensable adjunct of all ploughs is the skim-coulter; so indispensable that the writer does not believe that any satisfactory work can ever be done without it. Many champion ploughmen of the old school could, by adjusting the "rake" or set of the ordinary coulter, so twine a furrow-slice over that the grass was completely covered out of sight, sometimes using a dragging chain trailing from the coulter over the edge of the furrow-slice as it slipped past; but the liability of this to grow green in the "seams" before seed-time—especially during a mild winter—was great, and it is a mistake nowadays not to use the arrangements specially designed to obviate this defect, especially when the ploughmen are not of the best quality. In the digging plough, and even in the common chilled steel short-breasted ones, the skim-coulter is a very large

feature indeed; and a large slice of soil (sometimes the greater part of the surface of the furrow-slice, carrying the surface rubbish with it) is pared off and turned over into the bottom of the furrow. By this means there is less soil to be moved by the breast, while the complete burial of all grass, stubble, weeds, &c., conduces very much to keeping the land clean and to making a tilthy seed-bed. The writer once had some land ploughed with skims on the ploughs, and part of the same field (stubble land) ploughed without skims; the skimmed land showed up clean and bare after harvest, the unskimmed was so foul that it required to be immediately bare-fallowed.

It is a curious fact that the draught of the plough is not altered in the least by the presence or absence of a coulter. Its use is simply to cut the edge a little more cleanly than the front edge of the mouldboard would do, and it is almost unnecessary where a skim-coulter is in use. Indeed, in many of the American forms used on the prairies for ploughing the clean, loose, stubble soil, no coulter of any kind is used at all, the cutting edge of the breast being quite effective; but still, on some of our stiffer soils here, it is useful in giving a shape to the slice and a guide to the body of the plough. On such soils, if none is used, or if it is improperly set, the plough does not run so true or so steadily. Still, the fact remains that on most soils where a good slice is pared off the edge by the skim-coulter there is no need at all for the knife-coulter, especially on stubble land.

The disc- or wheel-coulter has not been a universal success for several reasons. It, of course, runs with less friction through the soil than does a knife- or skim-coulter; it does not gather any weed or dung rubbish on its edge as it runs along, and is therefore valuable for ploughing in surface dressings; but, on the other hand, it will not work on stony land, while it cannot be set so accurately as the knife-coulter—a matter of extreme importance in the case of swing-ploughs, where the least change in the set of the irons makes all the difference between easy, good work and the reverse. In a homogeneous soil, however, and with a wheel plough, these drawbacks disappear, but still the wheel-coulter can never take the place for efficiency of work of the skim. A new style of disc-coulter is now becoming

common in America, viz., one fitted to run on a swivel like a castor-wheel. The improvement consists in the fact that the setting of the coulter does not need to be so nice ; it adjusts itself to the running of the plough instead of guiding it.

Spring Bridle.

There is another little improvement which is quite common on transatlantic ploughs, but which we have never seen on one made at home, and that is the use of a spring clevis or bridle. This is, of course, simply a spring arrangement coming between the draught chain and the beam of the plough, whereby any shock or jerkiness from stony land or other cause is absorbed and the horses do not feel it. We are accustomed to see such an arrangement on some of our mowing machines, and it is a matter of surprise why an attachment of this sort is not more commonly in use. There were spring draught chains —two to each horse—brought out by somebody at one time, but the most suitable and convenient arrangement would be a single spiral spring fastened on to the central draught hook of the wey-tree of a set of whipple-trees, so that the one arrangement could be applied to all implements pulled by a couple of horses walking abreast.

The New Style of Ploughing.

In recent years from across the Atlantic have come new ideas as to the objects of ploughing. The old idea was to cut and turn over a furrow-slice where the width was to the depth as 10 to 7 (10 inches by 7 inches where the land allowed of this size, or in the same ratio), as this proportion mathematically and in practice was found to give a slice which would turn over and lie accurately at an angle of 45 degrees on both faces, where the section of the slice was rectangular. The new idea is now to "cultivate" the land as much as possible concurrently with the act of ploughing, and, consequently, the relation of the width to the depth is no longer a matter of importance if the work is left in a proper state and is done at a sufficiently quick rate. We therefore now, in the majority of cases—at least, where farmers are up-to-date in their methods—turn a furrow which is broken and pulverised in the act of ploughing as much as

possible, which is wide in proportion to its depth, and which has the surface rubbish completely buried underneath, and all this in place of the old style of having the furrow-slices squeezed and pasted up close to each other like so many bars of soap.

If the mouldboard of one of these new ploughs be compared with the old, it will be seen that the principal difference is in the comparative lengths of the two and the angle at which they are set. The new pulverising plough has a short, wide-set wrest which cracks and crushes up the soil as it goes along, *inverts the top rubbish, and spreads the loose soil (as shown in* Fig. 2, No. 4); thus making either a capital seed-bed straight away or else leaving the top rough and broken for the winter frosts to act on. The particular curve of the breasts also will be found to differ from the old forms. These latter have a tendency to be more convex on the earth side, but the new chilled steel ones are decidedly concave in their curve, and it is partly to the concavity that the pulverising action is due.

It must be acknowledged, of course, that for neat work on a piece of tough old turf, or on a stiff clay soil, many of the

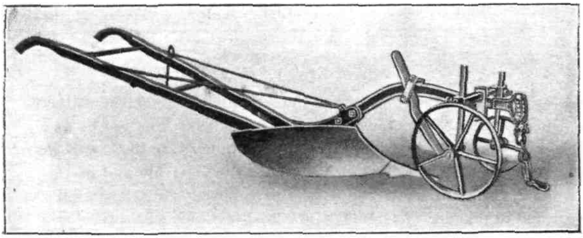


FIG. 3.—*General Purpose Chilled Steel Plough.*

"cultivator" forms of the modern plough are not suitable, excepting with a good cutting skim-coulter; but for work which is calculated to "turn up the virgin soil which never saw the sun," for burying grass or other surface growth, for breaking up the furrow-slice, these new varieties are desirable. Fig. 3 gives a good idea of the modern type of general purpose plough fitted with chilled steel breast, two wheels, and moderately long handles. A skim-coulter can be attached. Fig. 4 is one of the

best types of the original "Yankee Ploughs," the chilled steel pulverising form which led the way in the improvements in the working parts of all our modern ploughs. The adoption of longer handles and the fitting on of a knife-coulter as well as a skim-coulter has made it a good general purpose plough, the prototype of Fig. 3. In the form shown in the illustration it is pre-eminently valuable on the lighter class of soils for stubble work, but for a stiff grass furrow on clay land it requires to be made of the elongated type of Fig. 3.

As pointed out above, however, the benefits which accrue from the use of these modern ploughs, it must be acknowledged,

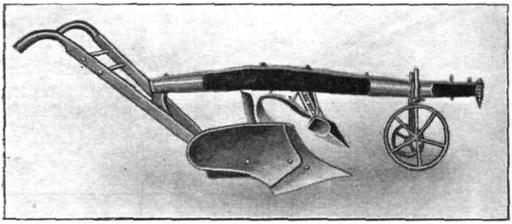


FIG. 4.—*Chilled Steel American Plough.*

are not so apparent on clay soil, as the pulverising action does not act so well as on loamy or other free-working soils. It is just on clay soils, however, that it is most needed, and the plough which will even only break up the slice into lumps without pulverising it is an advance. On such soils any plough of the swing variety is held with very great difficulty, and it is in a case of this kind particularly that the benefits which accrue from the use of wheels show up; a first-rate ploughman is helped very much, while a second-rate man is put on a par with him as far as the total and resultant effects of the work are concerned.

Digging Plough.

The chilled steel cultivating plough is, of course, made in several different forms, one of the most notable being the "digging plough," which is, practically, simply a larger size of the

other, as shown in Fig. 5, designed for doing the work extra deep and extra broken; while to do away with the necessity of leaving large and deep finishing furrows, reversible or one-way ploughs are common, whereby the furrow-slices are all laid one way, and there are no open furrows left at the finish at all. For sidelong or hillside ploughing one-way ploughs are particularly suitable, as the furrow-slice can then be always thrown downhill, thereby rendering the work much easier. A common practice in America is to plough round and round a field and finish in the centre. This system obviates all the trouble and waste of

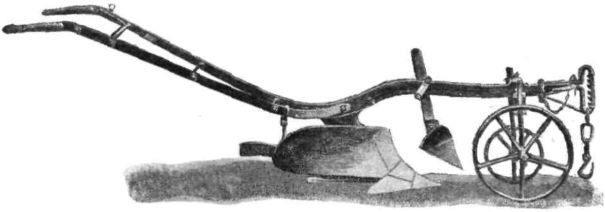


FIG. 5.—*Chilled Steel Digging Plough.*

labour connected with "drawing off" a field into ridges or stetches, making the finishing furrows and turning at the land ends.

In the writer's district, for instance, the ploughmen actually cannot "open up" a field—even where there are pre-existing furrows—without having the first furrow-slice "chucked away"; if this is not done, then the crown of each ridge will be made to stand up like a turf dyke down the field. Yet this system is actually approved of by the masters and encouraged at the ploughing matches. All this trouble and waste of labour would be obviated by the use of a one-way digging plough.

On digging ploughs and others of a similar nature there is sometimes fitted a tail-knife which cuts and still further divides the furrow-slice after it has passed from the mouldboard. This is an invaluable aid on clay soils which do not readily pulverise, where a wide and deep furrow is being taken, but is not so necessary on the lighter classes.

The Disc-Plough.

And now we come to the plough which is the most recent form of all, and which is only now being introduced into this country. This is the disc-plough, illustrated in Fig. 6, which in the great wheat-growing areas in the States is used in from one- to thirty-furrow sets, the latter pulled by a powerful traction-engine. The principle of it is simply the same as is adopted in the case of the disc-harrow, the disc-

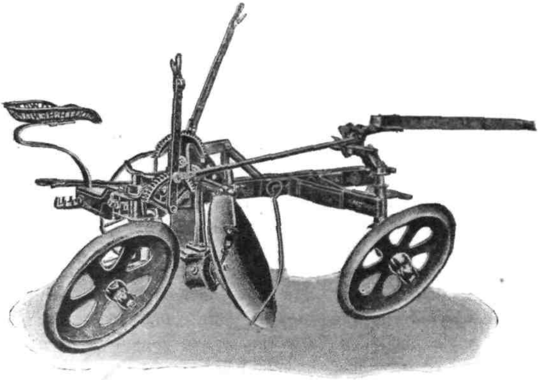


FIG. 6.—*Disc-Plough.*

coulter for corn drills, and other adaptations of the revolving disc. In this plough the place of the wrest with all its adjuncts is taken by a revolving concave circular plate of steel which—set at the same angles as the mouldboard would be fixed at, perpendicularly and horizontally—cuts its way through the land, revolving as it goes along, and turning over and pulverising the soil at the same time. The success of this implement on the other side of the Atlantic makes it certain that it would succeed here—at least on the lighter soils and in stubble work—while on the principle that rotation causes less friction than sliding, it must be easier of draught in proportion to the work done.

In its present form it is, of course, quite capable of improvement for British purposes; we have not, for instance, yet come across a variety with a skim-coulter in front, for it does the cutting work of the ordinary coulter as it revolves along, like a wheel-coulter in itself. Now for our work a skim-coulter is absolutely necessary. American farmers, with the best implements in the world, do their work in a very slip-shod and slap-dash manner, and in ploughing are not at all particular about making a tidy job and getting all the tails or rags of the surface growth hidden; a style of work which would be fatal to our crops in this damp climate and with our comparatively mild winters, and therefore a skim-coulter (which can easily be put on) is an absolute necessity, more especially in ploughing lea-land.

It must be acknowledged, of course, that a plough of this sort would not work very well in stony or rocky soil. Whenever it encountered a stone it would have a tendency to rise over it and thus be thrown out of the ground, but for all homogeneous soils of any kind, from sand to clay, it would work exceedingly well.

To sum up: the modern plough is developing into a machine like the following:—The frame will run on the adjustable wheels, to which is attached a disc-breast, with skim-coulter to suit; there will be a seat for the driver, a spring bridle attachment, the wearing surfaces of chilled and polished cast steel, and the whole of the frame and other parts of comparatively light malleable ribbed steel; while a trailing tail-knife or prong will be fitted on for the purpose of helping the breaking up and spreading of the furrow-slice. Probably one furrow will be adopted instead of two, but that will be wide in proportion to its depth, and be much broken up as it is turned over.

Double-furrow Plough.

When one begins to study the origin of customs, we find that some curious questions arise. For instance, it is an almost universal rule in this country to have two horses pulling together at the same plough. Why? We are bound to say that we do not know of any reason why, excepting that it is

simply a custom. As far as the ability to handle the horses or the implement is concerned there might just as well be three or four animals pulling it, with a corresponding size of plough, or a double or triple set of breasts. Our Colonial and American competitors have thrown all these hidebound traditions and customs to the winds, and have gone in for double, triple, quadruple, and any higher number of furrow ploughs, drawn by a corresponding number of horses, and all controlled by one man. They have, of course, large fields, or wide stretches of land for their use, but it is the adoption of these forms that is one of the factors in their cheap production of all kinds of crop, and we could most certainly partly adopt them here in many cases. On heavy land, of course, a single furrow-slice 9 inches wide by about 5 inches deep is about enough for a pair of horses to tackle with the ordinary old-fashioned ploughs, but with modern ploughs, and in fairly free-working land, three horses could quite well pull a double-furrow plough, and, indeed, in some instances it is done. Why double- and even triple-furrow ploughs have not "caught on" better than they have is not easy to explain, though there are two reasons which are apparent. One is that in the past a multiple-furrow plough has been of such a massive, clumsy make that there was no comfort in handling it—more especially in a district of small fields—and the other reason is that the ordinary ploughman does not want it to succeed. An implement or a system which is going to do the work with, say, half the usual number of men and horses, is not going to be hailed with pleasure by the ordinary working man—who fears he may lose his job—and, consequently, the innovation will not succeed unless it is tackled by the farmer himself or someone interested in its success. The rural population has so long been accustomed to one man attending to two horses and working with them that it will take some work to get that man to look after three; but it has been done. Some farmers have written in the agricultural press that they have induced their men to adopt the system by a small rise in their wages, and it is only a matter of keeping the thing going for a little while to make it a custom and habit. The adoption of a duplex plough with one man and, say, three horses to work it, is certainly a modern development

of ploughing which might be very successfully adopted in many cases, and would certainly help to cheapen the cost of production. One of the best and most modern forms of double-furrow ploughs for three-horse work is illustrated in Fig. 7—combining lightness, strength, and simplicity with efficient work.

At the same time, there is a great deal to be said in favour of sticking to the old system of pair-horse work. If a double-furrow plough is adopted, requiring three horses to pull it, it means that another man's pair must be broken up to get the third horse, and this is an innovation which the men in some districts would never agree to. If, on the other hand, it is arranged that one man shall handle three horses, then it means that all our other implements will have to be on a

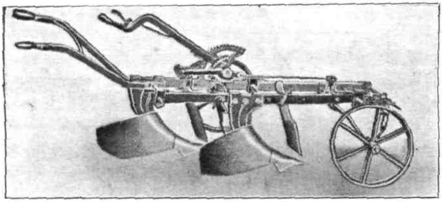


FIG. 7.—*Double-furrow Chilled Steel Plough.*

three-horse scale—harrows, rollers, mowers, &c., &c. It is doubtful if this would be any benefit in the long run, while it certainly would involve a tremendous expense and upset on a farm. It could not be applied in the case of carting, for while one man can handle two horses with two carts, or a two-horse waggon, three horses are out of the question. If ploughing were the only or the principal kind of field work done on a farm—as is the case in some districts in America—then a double-furrow plough with three horses would be an undoubted benefit; but the difficulty of getting a three-horse system to fit in all the year round, at all sorts of work, must be considered by anyone who thinks of adopting this innovation.

It has been said that no one plough can do all the different kinds of ploughing required by a farmer—not merely on different kinds of soil but on the same kinds of soil on the same farm at different times. The implement which does

stubble work fairly well, or which makes good enough work on a bare fallow, may be quite unsuited for ploughing up grass land. Again, a plough which does well on a light, sandy loam may be a complete failure on a stiff clay. The converse of these statements, however, does not hold true, for a plough which will turn over a satisfactory furrow in a stiff clayey pasture will work satisfactorily anywhere else. On a rough fallow, of course, wheels will not run very well, though even that difficulty can be met. The writer has tried many ploughs in his time, and on many different soils, and is of opinion that many of the modern

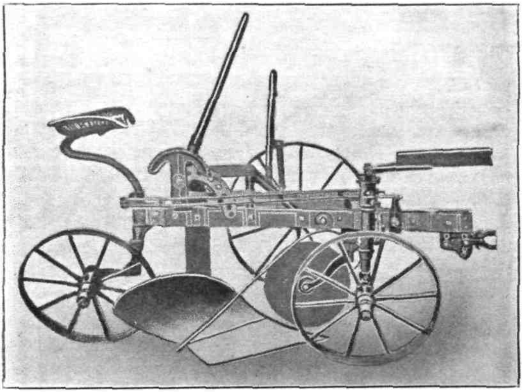


FIG. 8.—*American Gang Plough.*

forms, which have two or three wheels, a skim-coulter, and a chilled steel breast, will serve well as general purpose ploughs and do any kind of work better than the old ones.

For information and comparison an illustration of an American sulky plough is given; with high wheels and a seat the work is done as comfortably as driving a mowing machine (Fig. 8).

Special Ploughs.

It is not possible, within any reasonable limits, to go into the merits and demerits of all the "special" kinds of ploughs which

are used for various purposes in different districts. The typical varieties of the common form have been discussed, and the principles which apply to them should act as a guide in respect of all the others. These others may be classified under such headings as :—

Subsoiling.
Ridging.
Paring.
Potato Raising.
Draining or Gripping.
Multiple-furrow.
Steam.

Many of our common general purpose ploughs can be converted into the digging, subsoiling, ridging, paring, potato-raising and gripping forms by simply taking off the working parts and fitting on the suitable " irons " (now steel-made) for the work in hand, and a convertible plough of this sort is a decidedly useful implement on a farm. For subsoiling a special tine is fitted on in front of the breast, which penetrates and tears through the soil along the bottom of the *previous* furrow ; or else the "irons" are taken off and a special chisel share put on, which rips up the "pan" or hard bottom of the furrow behind another plough. One maker in this way advertises a plough which can be converted into 26 different implements!

The ridging plough—sometimes called the double mouldboard plough—is simply one with a right and left breast to throw the mould out to both sides and thus make a balk or ridge for roots or potatoes. Nowadays there is an increasing tendency to fit these breasts in two or three sets on to the modern cultivator frame—a vast improvement—but they can be had adapted to fit on to the ordinary plough frame.

For paring, a share with an extra wide feather, or cutting edge, is put on, and the plough set to a shallow depth to suit the thickness of turf wanted.

For potato raising a ribbed frame, like the fingers of an open hand, is fitted on in place of the sole-plate—the "irons" and breast being removed—and the earth containing the potatoes flitters through the prongs or ribs as the plough passes along

through the ridge or balk, leaving the tubers mostly on the surface.

The draining or gripping form can also be adjusted on to the ordinary frame. This is for cutting a small trench or "groep" in grass land on clay soil, to help the running off of the surface water. This can, of course, be done by the ordinary plough, set over to the "land" side so as to run edgeways, and thus cut out a triangular furrow-slice; but a special cutting share and other parts can be fitted on with some makers' ploughs, and do much better work.

The multiple plough is simply the double-furrow form with extra shares and breasts for use on light land where one or two furrows do not absorb all the force of an ordinary team of horses. The furrows cut are usually smaller in size than with the regular ordinary plough, and the work is mostly done where seed is ploughed in to a shallow depth, or in working a loose fallow.

The steam plough is the adaptation of the plough to a giant scale of work to suit the unlimited power which can be developed by a large engine. It is a multiple plough, on the same scale as the largest of single-furrow ploughs, while of necessity it is also a one-way plough. It is worthy of note that the benefits of steam ploughing have been largely handicapped by the depth of our ordinary soils. If the soil is only 6 or 7 inches deep then it has proved a disastrous mistake to tear it up to a depth of, say 8 or 9 inches, which the giant power of steam made quite easy, on account of the often poisonous nature of the subsoil. Ordinary ploughing can, as yet, be more cheaply done on the ordinary scale met with on British farms by horse-power, and as extraordinary ploughing has not been found desirable the use of the steam plough has much fallen into abeyance during the last twenty years, though the steam cultivator has always been in great demand. In connection with this point it is worthy of note that steam ploughing by *direct traction* is the order of the day on the great wheat farms of California.

The engines have immensely wide wheels fitted with speeds to give a greater "bite" on the ground, while twenty to thirty furrows turned behind at one sweep is the rule. Another point worthy of note is that the ploughs are often the disc variety

above described, so that the land is fit for seeding straight away without any further preparation. Even when on a smaller scale horses are used, four horses pulling a four-disc plough is common, with one man riding and controlling the whole.

Within the last year or two the motor-plough has been coming to the front in this country, and is likely to be still further developed. The convenient adaptability of the oil-engine is rendering this possible, and the invention of a direct traction motor adaptable to all kinds of farm work is now practically accomplished. In connection with these labour-saving devices—such as double-furrow ploughs, motor-ploughs, &c.—it must, however, be kept in mind that there may be no benefit or saving in the total expenses of the farm. If a certain number of men and horses are needed to carry on the work, taking the twelve-month round, then the getting of a costly outfit to do one job, such as ploughing, may only be a ruinous addition to the expenses; we need, for instance, a crowd of men to do hoeing, harvesting, root-lifting and other kinds of work, and this crowd of men, with the corresponding number of horses, must be kept on while the motor is doing some of their work. This applies all round, of course, so that motors must either be developed to do all the work or else be done without altogether. The limits of two-horse work are by no means yet reached, while enough has been said above to show that there is great room for improvement in both ploughs and ploughing in the old style.

Conclusion.

Many of these methods could not, of course, be adopted here in our small fields, wet climate, and, perhaps, stiff clay soil; but it is desirable that the implements our competitors use, and their methods of use, should be known to us, to realise where we are in the struggle for agricultural existence. Some of their ploughs and style of work we have adopted already in modified forms, but there is immense room for improvement yet, and the writer has endeavoured to show in the above pages what are the most recent ideas on the matter, both as regards the plough itself and the style of work which should be done by it. That in many districts in this country we are a long way behind, the

writer has reason to know to his sorrow. There is a great deal more bad ploughing about than good, and this is not altogether the fault of the men, for there are whole districts where not one farmer in twenty understands either the plough or the work it is intended to do, although they may have been at it all their lives. Some keep on working with the old wooden plough, which has not been much altered since the days when Alfred was king of the West Saxons, and any attempt to introduce a modern improved variety, with chilled steel working parts, steel frame, and wheels, is resented. Some who have tried a modern form have not had the knowledge or the patience to adapt it to their land or special work, and have thrown the implement aside and returned to the good old historic methods. It is certain, however, that, if our arable farming is to head the procession of the world in the future as it has done in the past, modern implements and modern styles of work must be adopted; and while some districts in these islands have put into practical use most of what has been said above, there are other districts where they have not yet learned the alphabet of ploughing.

PRIMROSE M^C^CONNELL, B.SC., F.G.S.

ON THE BROWN-ROT OF THE SWEDISH TURNIP. WITH A NOTE ON THE SAME DISEASE OF THE CABBAGE.

The brown-rot of the swede (*Brassica campestris rutabaga*), of which I propose to give a short account, has been under my observation since 1898. During these five years I have found it very generally prevalent throughout Northumberland, occurring notably from October onwards in roots still growing in the fields, and very frequently to be met with in the store-heaps. In this locality the attack has been entirely upon the swede, and its manifestation has been chiefly confined to the root, the leaves presenting no sign of infection so far as I have been able to observe.

The disease is due to the action of bacteria, and has hitherto in England remained undescribed upon the swede or turnip, but its appearance has been noted upon the cabbage, and it is known to have caused great damage to cruciferous crops in America and on the Continent. It is, therefore, very desirable that a general description of its characteristics should be given.*

This brown-rot was first described by Pammel † (1895) as present in Iowa among swedes and yellow turnips, in some cases more than 50 per cent. of these crops being destroyed during the wet season of 1892 and 1893. Pammel isolated a bacterium which he proved to be the cause of the disease. Subsequently Smith ‡ extended his work and published accounts confirming Pammel's earlier observations, and giving more detailed investi-

* I have in course of preparation a scientific account dealing more specially with the pathological features of the disease.

† *Bacteriosis of Rutabaga*. Iowa Agricultural College. Bulletin No. 27, 1895.

‡ *Pseudomonas campestris (Pammel) the Cause of a Brown-Rot in Cruciferous Plants*. Centralblatt für Bakteriologie u.s.w. Abt. II., Bd. III., 1897. *The Black-Rot of the Cabbage*. U.S. Department of Agriculture. Farmer's Bulletin, No. 68, 1898. *The Effect of Black-Rot on Turnips*. U.S. Department of Agriculture, Bulletin No. 29, 1903.

gations into the nature of the attack, which he completely proved to be of a pathogenic character and due to a bacterium, *Pseudomonas campestris*. Smith noted the failure of a whole crop of white turnips in Baltimore, and heavy losses to market gardeners in Racine (Wisconsin), through the destruction of cabbages, both of which he showed to be due to the same species of bacterium.

One of the most noticeable features of the disease is the brown or black staining of the tissues occupied by the bacteria. The coloured drawing here reproduced represents exactly the appearance of the roots as I have found them attacked in the fields. In the initial stages the outermost wood-vessels are the first to be invaded, and these can be clearly distinguished by the naked eye standing out as dark brown spots near the rind (see figure); often every one of these wood-bundles is thus discoloured, and a ring of dark spots marks out their position at the periphery of the root. The more internal bundles are also indicated by dark spots extending radially. As the attack proceeds the discolouration may be traced outwards to the rind and inwards to the centre of the root; this gradually extends and develops until a large portion, and often the whole "flesh," becomes a dark brown mass (see figure). Even in the advanced stages, however, the tissues remain firm to the touch and are not reduced to a soft, pulpy condition.

The disease is of a markedly vascular character, its progress being clearly traceable along the woody portion of the vascular bundles, and, in the early stages, at least, the bacteria are entirely confined to the cavities of the wood-vessels and intercellular spaces.

The various inorganic salts absorbed by the roots from the soil are conveyed to the leaves by means of the wood-vessels. These wood-vessels contain in addition soluble carbohydrates, and hence their contents are of a nature to greatly favour the invading organism. It will thus be readily understood why the bacteria should proceed in this direction, and also the great damage which ensues to the plant from the blocking up of the wood-vessels and consequent stoppage of the supplies necessary for the manufacture of its food material.

I have succeeded in producing all stages of the disease upon

perfectly sound healthy roots, by inoculation with a pure culture of a bacterium which I isolated from naturally decaying roots, and which proved to be identical with *P. campestris*. Specially prepared pieces of healthy swede sown with a pure culture, under strictly sterile conditions, soon became infected, showing the brown discolouration of the tissues and all the peculiar characteristics of the attack. Bacteria again isolated from these in the same manner and sown upon similar blocks of swede always produced the same result, leaving no doubt that the disease in question was caused by this particular species of bacterium.

As will be observed by reference to the figure, this plant had formed a large well-grown root before the infection commenced. This I found most commonly to be the case, and it is in somewhat striking contrast to the manner of attack as described by Smith, who found the dwarfing of the plants a strong characteristic. He states that turnips attacked by brown-rot do not enlarge much radially, and that numbers which he examined, though several months old, in form more resembled carrots than turnips. According to this author's observations the infection took place chiefly through the leaves, and presumably his specimens became a prey to the disease at an early age, which would account for the arrested growth.

So far as I know, this disease has only been reported in England upon cabbages. In America the havoc which it has wrought is very serious. At Racine (Wisconsin) the damage for three years was estimated to exceed £20,000. In Illinois the acreage under cabbages has been much reduced, and on Long Island the cabbage-growing industry was threatened with extinction owing to this disease. In some cases entire fields were totally destroyed by it, and the loss throughout the State of New York is said to have amounted to many thousands of dollars. It is reported by Jones * as being widespread in Vermont, and apparently on the increase. The epidemic is stated to have been rampant in no less than eighteen of the States of America, and recent researches of Stewart and

* *Black-Rot, a Disease of the Cabbage and Turnip.* Vermont Agricultural Experiment Station, Burlington, Vt. I. Bulletin No. 66, 1898.

Harding* have brought out the fact that the germs of the disease have become so abundantly and widely distributed that it has been found impossible to discover any means of checking it. Hecke† has also described the same attack as widely distributed in Austria, destructive in gardens in the neighbourhood of Vienna and in various districts in the Tyrol. Harding‡ mentions it in widely separated localities in Europe.

Smith has shown by experiments that the natural method of infection is chiefly through the water-pores of the leaves and also through the agency of slugs and caterpillars. I have always observed the infection to have commenced through some injury to the root. Many parasites, both among fungi and bacteria, have no power to penetrate the hard outer rind of the sound root, and only find an entrance when the way is opened by injury inflicted by some agency such as that described. The amount of harm done by slugs, snails and caterpillars, and other destructive larvæ in the soil is incalculable, and it would be well if more could be done to eradicate such pests before the crops are sown.

The attack being confined to the Cruciferæ, crops belonging to this order should not follow each other for several years, the decaying plants ought not to be given to stock, nor should the manure from animals fed on these plants be used for crops liable to the infection. A serious outbreak of brown-rot has been traced to infected manure. If also the rotting plants are allowed to remain in the field the germs infect the soil and are ready to infest the succeeding crop.

It may be useful to add that the disease above described is easily recognisable on cabbages. There is the same blackening of the tissues along the path of the vascular bundles. Black spots appear upon the margins of the leaves and the discolouration extends along the veins. If the leaf-stalk is cut transversely the veins occupied by the bacteria can be seen as black dots.

* *Combating the Black-Rot of Cabbage by the Removal of Affected Leaves.* New York Agricultural Experiment Station. Bulletin No. 232, 1903.

† *Die Bacteriosis des Kohlrabi.* Zeitschrift für das landwirthschaftliche Versuchswesen in Oesterreich, 1902.

‡ *Die schwarze Fäulnis des Kohls und verwandter Pflanzen.* Centralblatt für Bakteriologie u.s.w. Abt. II., Bd. VI., 1900.

The plants show signs of wilting, and the heads become dwarfed and distorted, as the disease proceeds from certain centres of infection.

The precautions mentioned above apply equally to cabbages, and very serious destruction to this crop has been traced to infection spread in this manner. It is advisable for seed-beds to be changed each year, and it is better not to employ soil upon which a cruciferous crop has been recently grown. In one case of extensive damage the same plot of land had been used for a seed-bed for several years, and cabbages had been planted on the same land for seven years in succession.

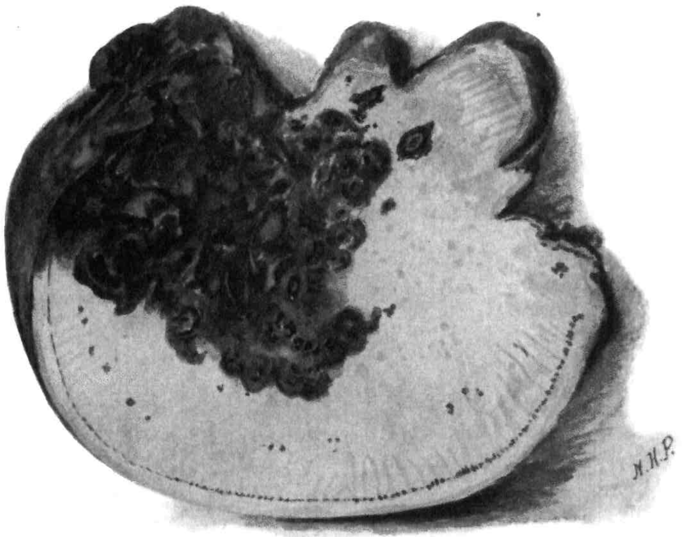
The removal of affected leaves at frequent intervals and their subsequent destruction has been recommended, and this treatment was considered to have met with success, but more recently Stewart and Harding have shown by a series of practical field experiments that leaf-removal is worthless as a method of controlling the disease, and that it considerably reduced the yield per acre. This treatment would obviously be valueless where the infection commences through the roots.

It seems probable that our greater immunity from this disease in England may be due to a better system of rotation of crops, and also possibly to the temperature in this country not attaining the high summer temperature of America—80 degrees to 90 degrees Fahrenheit or higher—which Smith has shown to be the most favourable for the growth of this germ, particularly when accompanied by a damp atmosphere.

M. C. POTTER.

DESCRIPTION OF PLATE.

Transverse section of a Swede attacked by Brown-rot, from a field at Cockle Park. On the upper left hand corner the disease has considerably advanced into the interior, while the brown dots extending round the periphery indicate an early stage of attack in the vascular bundles.



BROWN-ROT OF SWEDE

EXOTIC CONIFERS IN BRITAIN.*

Although Great Britain has only a small percentage of forest land, she is able to show a great variety of extra-European species of trees, many specimens of which have attained to a size that is probably not equalled elsewhere in Europe. It must be said, however, that much more attention has been given to the introduction of conifers than of dicotyledons, a result doubtless due to the fact that the humid climate of Britain is pre-eminently adapted to the requirements of the former class of trees. There seem to be, speaking generally, three outstanding features in the exotic coniferous trees of Great Britain :—(1) Their age ; in a large number of cases we possess the oldest specimens in Europe. (2) Their size ; the rate of growth being usually very satisfactory. (3) Their abundance ; the number of places where important collections of well-matured conifers are to be found being counted by hundreds.

Of the species of trees now growing in Britain only a few are known to have been present in pre-glacial, inter-glacial, and post-glacial times. With regard to some of these it may be said that although they are present in Britain to-day, and were undoubtedly present in pre-Roman times, it is possible that they became extinct in prehistoric times to be afterwards introduced by the Romans, or in the period subsequent to the Norman Conquest. This is certainly true of *Picea excelsa*, *Rhamnus frangula*, *Pyrus torminalis*, *Pyrus aria*, and *Carpinus Betulus*, whose remains have been found in pre-glacial deposits, but not in the peat bogs or other deposits of post-glacial times. The Spruce is believed to have been re-introduced by man in the sixteenth century. Perhaps it is fair to assume that trees met with in the peat bogs and fluviatile and lacustrine deposits

* Translation of a paper contributed by Dr. Somerville to the Congress of Forestry Experimental Stations, Vienna, September, 1903.

of post-glacial times have persisted right through the centuries that separate the Neolithic period from the present day, and that such species are therefore, in the strict sense of the term, indigenous to Britain. The following is the list (omitting mere shrubs such as *Prunus spinosa*, *Viburnum opulus*, *Sambucus nigra*, *Cornus sanguinea*, *Salix cinerea*, &c.):—*Ilex Aquifolium*, *Acer campestre*, *Prunus domestica*, *Prunus Avium*, *Prunus Padus*, *Pyrus Aucuparia*, *Pyrus communis*, *Crataegus oxyacantha*, *Fraxinus excelsior*, *Ulmus montana*, *Betula alba*, *Alnus glutinosa*, *Corylus Avellana*, *Quercus sessiliflora*, *Quercus pedunculata*, *Fagus sylvatica*, *Salix caprea*, *Populus tremula*, *Taxus baccata*, and *Pinus sylvestris*.*

A few are believed to have been introduced by the Romans, *e.g.*, *Juglans regia*, *Castanea vesca*, *Acer Pseudoplatanus*, *Tilia europaea*; while others found their way to Britain in the sixteenth or seventeenth centuries, *e.g.*, *Aesculus Hippocastanum*, *Populus alba*, *Picea excelsa*, *Abies pectinata*, *Larix europaea*. Although the last-named was introduced about the middle of the seventeenth century, it was not till the second quarter of the eighteenth century that its cultivation, especially in Scotland was undertaken on a large scale.

The introductions of the nineteenth century are much the most numerous and interesting, and it is chiefly these that occur to our mind when we speak of the acclimatisation of exotics. Before, however, reviewing these recent introductions, it may be well to look for a little at the climate of Britain, the peculiar character of which has proved so favourable to tree-growth.

The climate of Britain is characterised by the comparative mildness of the winters and the coolness of the summers. If these two factors varied to a like extent, the mean temperature of London would be the same as that of other places in the same latitude, say, Warsaw; but, instead of this, we find the mean temperature of London to be the same (about 49·5 deg. F.) as that of Vienna, which is situated over 3 deg. of latitude further south. The contrast with Munich is even more striking, the mean annual temperature of this city being about 4 deg. F. below that of London. This means that the mildness of the English winter is relatively more pronounced than the coolness

* Clement Reid. *The Origin of the British Flora.*

of the English summer. In January the mean temperature of much of Ireland and of the west of Scotland and England is the same as that of Avignon, Florence, and Constantinople; whereas in July London is not so warm as Memel, which lies more than 5 deg. further north. In winter the greater part of Britain is 10 deg. or 12 deg. warmer than Munich or Vienna, whereas in July the temperature of Vienna is nearly 7 deg. F. above that of London.

While the rate of tree growth may be much affected by summer temperature, what determines the question as to whether a particular species may be successfully grown in a place is not so much the mean summer or mean winter temperatures as the minimum winter temperature. On the west coast of Scotland and England, and over the greater part of Ireland, it is a comparatively rare event for the temperature to sink below 20 deg. F., while any snow that may fall lies for, at most, but a few days. In the centre and east of England and Scotland two or three weeks of frost may be experienced each winter, when the thermometer may sink to 15 deg. F., and occasionally, though very rarely, to below zero. The figures for certain stations for the five years 1893–1897 are shown in Table I., which has been kindly compiled for the purpose of this paper by the Meteorological Office.

It is in winters of unusual severity that the climate of Britain contrasts most favourably with that of the rest of Europe. February, 1895, was an exceptionally cold month over the whole of Europe, but the mean minimum temperature (24 deg. F.) of that month in London was no lower than that experienced along the west coast of France, and in the Riviera, Central Italy, and Turkey. In the same month the mean minimum temperature was 18·5 deg. F. in Vienna, and 16·5 deg. F. in Munich, while the absolute minimum temperature recorded was 11 deg. F. in London, 4·5 deg. F. in Vienna, and −4 deg. F. in Munich. Other data are shown in Table II., the figures being given to the nearest half-degree.

In the month of May, Britain and Austria have each about 200 hours of sunshine, whereas in December the amount of sunshine in Austria (50–100 hours) is about double that in Britain. On the mean of the year Britain gets from 27 to 36 per cent. of

its possible sunshine (1,200–1,600 hours), whereas Austria gets 40 to 50 per cent. (1,800–2,000 hours).

TABLE I.

MEAN, GREATEST, AND LEAST NUMBER OF DAYS PER ANNUM ON WHICH TEMPERATURE FELL BELOW CERTAIN LIMITS, AND JANUARY TEMPERATURE DURING THE FIVE YEARS 1893–7.

	Below 23 deg. F. Number of Days.		Below 14 deg. F. Number of Days.		Below 5 deg. F. Number of Days		Mean January Temp. Degrees Fahrenheit.	
	Mean.	Extremes.	Mean.	Extremes.	Mean.	Extrms.	Mean.	Extremes.
London (Kew)	6·6	15 & 1	1·0	3 & 0	None.		33·0	29·5 & 36·5
Cheltenham ...	12·8	34 & 4	2·6	9 & 0	None.		31·0	35·0 & 25·0
Cambridge ...	13·2	25 & 7	2·6	8 & 0	None.		29·5	34·0 & 27·0
Plymouth ...	2·4	6 & 0	None.		None.		35·0	36·5 & 31·5
Southampton ...	6·6	20 & 0	One	Occasion	None.		33·0	37·0 & 29·5
Wiesbaden ...	25·0	46 & 14	7·6	20 & 0	2·6	7 & 0	25·5	31·0 & 18·0
Berlin	28·8	40 & 21	9·0	20 & 0	1·8	6 & 0	22·0	27·5 & 12·5
Munich	45·2	63 & 34	18·4	35 & 2	7·6	19 & 0	18·0	24·0 & 9·5
Memel	45·6	67 & 20	23·6	40 & 10	9·6	24 & 2	17·5	24·0 & 2·0
Vienna	33·2	50 & 12	10·4	21 & 1	2·2	5 & 0	20·5	28·5 & 13·0
Novgorod ...	134·0	147 & 129	92·0	118 & 71	53·0	68 & 35	1·5	7·5 & 8.0*

* Below zero.

TABLE II.

	Mean Temperatures.			January, 1895.		February, 1895.		Lowest Temperature recorded *1871–1900.*
	Year.	Jan.	July.	Mean Min.	Absol'te Min.	Mean Min.	Absol'te Min.	
	F.	F.	F.	F.	F.	F.	F.	F.
London (Kew) *1871–1900* ...	49·5	38·5	62·0	29·5	21·0	24·0	11·0	9·0
Cheltenham *1881–1900* ...	48·5	37·5	61·0	25·0	15·0	20·5	6·5	3·0*
Cambridge 1871–1900 ...	49·0	37·0	62·0	27·0	15·0	20·5	6·0	Zero.
Plymouth 1871–1900 ...	51·0	42·0	61·0	31·5	22·0	28·5	19·0	17·0
Southampton 1871–1900 ...	50·0	40·0	62·0	29·5	19·0	24·0	14·0	13·0
Berlin 1851–1890 ...	48·5	32·0	66·0	23·0	4·5	20·5	6·0	—
Munich 1851–1880 ...	45·0	27·5	63·0	18·0	1·0*	16·5	4·0*	—
Memel	45·0	26·0	63·0	22·5	1·5	14·5	4·5*	—
Novgorod ..	38·5	11·0	67·5	7·0	13·0*	3·0	13·5*	—
Vienna 1851–1880 ...	49·5	30·0	68·5	23·0	13·5	18·5	4·5	—

* Below zero.

In January seven-tenths of the sky in Great Britain is obscured by cloud, whereas in Austria sixth-tenths only is covered by cloud. In July the sky is clouded to the extent of

sixth-tenths in the south of England, and eight-tenths in the north of Scotland, as contrasted with only four-tenths in Austria.

As regards annual rainfall it may be said that the east of Britain receives 20 to 30 inches, whereas twice this amount falls in the west, some small areas receiving more than 150 inches. The larger part of Germany and Austria receives annually about 30 inches of rain, 40 inches falling in the Harz and Carpathians, and 60 inches in some parts of the Tyrol.

The early introduction of exotic trees into Great Britain was by no means a matter of chance. On the contrary, it was the result of a strong demand on the part of landowners, to satisfy which systematic expeditions were organised, either by (*a*) existing societies, (*b*) special associations, or (*c*) commercial nurserymen. In all cases, other plants besides trees received attention, though in some cases trees, and especially conifers, were the main object. In 1823 David Douglas was engaged by the Horticultural Society of London, and, after a short visit to the Eastern States of North America, he sailed in 1824 for North-West America, where he remained till 1827. After two years at home, he sailed for California in 1829, and met with a tragic death in the Sandwich Islands on July 12th, 1834. To Douglas we owe many of our most valuable conifers, *e.g.*, *Pinus insignis*, *P. Coulteri*, *P. lambertaina*, *P. monticola*, *P. ponderosa*, *Abies amabilis*, *A. bracteata*, *A. grandis*, *A. nobilis*, *Picea sitchensis*, and *Pseudotsuga Douglasii*.

It was also the Horticultural Society that sent Theodor Hartweg to North America in 1845, the most notable of whose introductions were *Sequoia sempervirens*, and *Cupressus macrocarpa*.

In 1843 the same society had sent Robert Fortune to China, and to him we owe *Cryptomeria japonica* and other trees of lesser importance. The cost to the society of despatching collecting expeditions from 1840 to 1846 amounted to £3,837 13s. 1d.

In 1849 an association was formed in Edinburgh which had for its object the despatch of a collector to North-West America. This association—known as the Oregon Botanical Expedition—was supported by landowners and nurserymen, chiefly Scotch,

each subscriber taking at least one share of £5, the results of the expedition to be divided amongst the members according to the number of £5 shares. The sum subscribed in the first year was £950; subsequently increased to £1,445, most members taking a single share, though some—chiefly nurserymen—taking four to six, and even up to ten. John Jeffrey was appointed collector, and sailed for Montreal in June, 1850, reaching the district west of the Rocky Mountains in the following year. The Hudson's Bay Company granted him a free passage, while the Admiralty promised to assist with their ships on the North-West Coast of America. The first consignment of plants and seed arrived from San Francisco in 1852, the postage of which amounted to £135, but the Post Office authorities generously agreed to waive their claim. To Jeffrey we owe *Abies lasiocarpa*, *T. mertensiana*, *Thuja gigantea*, *Libocedrus decurrens*, *Pinus flexilis*, *P. balfouriana*, *P. murrayana*, and *P. Jeffreyi.**

In 1854 an expedition was undertaken to California by Messrs. Beardsley and Murray, and the result of their efforts was the introduction of that fine tree, *Chamaecyparis lawsoniana* and one or two others of much less importance.

One other private expedition may be mentioned, namely, that of John Gould Veitch, a member of a famous firm of English nurserymen, who, in 1860, set out for Japan, and was instrumental in introducing *Larix leptolepis, Abies firma, Picea polita, P. ajanensis, P. alcockiana* and others.

The number of species of conifers that find conditions more or less suitable to their requirements in some part of Great Britain and Ireland considerably exceeds 100. Mr. Dunn, in his census prepared for the Conifer Conference of the Royal Horticultural Society in 1891, gives the dimensions of 102 species. I do not, however, propose to include in this paper any that are not at least fairly common, and which hold out the prospect of attaining the dimensions of useful forest trees.

With few exceptions exotic trees in Great Britain are grown in isolated positions, so that their stems are covered with branches quite down to the ground. The result is,

* I am indebted to Professor Bayley Balfour for access to the minutes of the Edinburgh Oregon Association, and for the perusal of some of Douglas's correspondence.

that for any given age, their girth at breast-height is greater than would be the case with trees of a similar age grown in close forest. On the other hand, the height is probably less than it otherwise would have been. The circumference is given at 4½ feet from the ground. The ages given are calculated from the time of planting, at which time the tree would, as a rule, be four years old, so that to get the actual age from the time of sowing the seed the figures would generally have to be increased by four.

The dimensions given for the various species are not averages, but are the result of actual measurement of individual trees situated in the districts indicated. As a rule, for any given age, the largest tree has been selected. Some may think that this is not a fair index of what a particular species may be expected to attain to at any given age, but I am disposed to think that the maximum height recorded for a certain age, in the case of a tree grown in a garden or park, is more likely to represent what may be looked for, when the same species is grown in close forest, than the average height of all the trees of that age would be. It is to be remembered that the figures that follow are taken, for the most part, from "specimen" trees, and that in their case there has been little application of the law of the survival of the fittest. Suppose that forty years ago an order was given to a nurseryman for five Douglas firs about 3 feet high, the plants supplied might vary from three to six years of age. A Douglas fir that attains the height of 3 feet in three years may be regarded as an individual with a natural tendency to vigorous growth, whereas if six years be taken to reach the same height the particular individual is manifestly a slow grower. If the five Douglas firs were intended for landscape effect, each would be set out with abundance of room, and, no matter whether it grew fast or slow, it would be allowed to survive. At the end of forty years the tallest of the trees might be 80 feet, while the smallest might not exceed 40 feet, giving an average of, say, 60 feet. But if a number of Douglas firs were planted 3 or 4 feet apart, and managed in true sylvicultural fashion, the only individuals that would survive to the age of forty years would be those with a natural tendency to rapid growth; all the others would long before have been suppressed

or removed in the thinnings. The average height of the wood would therefore be not 60 feet, but 80 feet; hence it follows that in converting the results of arboricultural treatment into terms of sylvicultural treatment we should take as the basis of our calculations not the average but the largest trees. I am aware, of course, that "specimen" trees are usually set out in good soil and in well-sheltered and otherwise favourable situations, but, on the other hand, they lack the "drawing-up" influences of a closely stocked wood.

In the following tables it will sometimes be found that a young tree has attained to greater dimensions than an older one. The reason for this may be explained. In dealing with any particular species the choice of specimens decreases with age, that is to say, whereas we may have twenty measurements of twenty-year-old trees from which to select, we may not have more than one or two in the case of sixty-year-old specimens of the same species. The chances of being able to record the dimensions of a "dominant" tree of the latter age are, therefore, relatively small.

In compiling the following tables, free use has been made of Mr. Dunn's census,* though other reliable sources have also been drawn upon. In many cases I have been able to secure measurements in June, 1903, of the same trees whose dimensions, in the spring of 1891, were recorded by Mr. Dunn. In this way a record of the growth made during the last twelve years has been obtained. In some cases the particular tree has lost its top in the interval between the two measurements, which accounts for the height recorded in 1903 being sometimes less than that given in 1891.

Abies amabilis, Forb.—Quite hardy, though not very common. The following measurements are recorded :—

* *Jour. Roy. Hort. Soc.* 1891, Vol. xiv., p. 481.

No.	Age, years.	Height. Feet.	Girth. Ft. In.	County.	Remarks.
1	14	12	0 9	Cambridge.	
2	17	32	3 0	Dumfries.	Measured 1891.
3	20	29	2 0	Aberdeen.	
4	29	44	4 10	Dumfries.	Same tree as No. 2, measured 1903.

Abies bracteata, Nutt.—Not common. Requires the climate of the milder districts of Britain :—

Age, years.	Height. Feet.	Girth. Ft. In.	County.
20	21	1 1	Forfar.
30	49	4 6	Cornwall.
37	40	4 9	Gloucester.

Abies cephalonica, Loud.—Quite hardy after it is fairly established, and extensively planted :—

No.	Age, years.	Height. Feet.	Girth. Ft. In.	County.	Remarks.
1	18	37	2 7	Lanark.	
2	30	47	5 0	Perth.	
3	45	70	9 4	Kent.	Measured 1891.
4	51	53	8 8	Kildare.	
5	57	73	11 0	Kent.	Same tree as No. 3, measured 1903.

Abies concolor, Lind. et Gord.—Hardy everywhere, and much planted :—

No.	Age, years.	Height. Feet.	Girth. Ft. In.	County.	Remarks.
1	12	15	1 2	Edinburgh.	
2	17	30	2 0	Waterford.	
3	25	54	4 7	Kirkcudbright.	
4	30	64	8 7	Kent.	Measured 1891.
5	36	45	6 10	Queens.	
6	42	87	11 7	Kent.	Same tree as No. 4, measured 1903.

Abies grandis, Lind.—A little affected by cold wind and severe frost, but practically hardy. Many planters speak enthusiastically of its rate of growth :—

Age, years.	Height.	Girth.	County.	Remarks.
	Feet.	Ft. In.		
16	25	2 0	Wicklow.	
20	68	5 5	Lanark.	
24	68	5 1	Perth.	
32	65	5 0	Forfar.	
42	86	8 0	Buckingham.	Has grown 21 ft. in height in last 10 years.
43	87	8 0	Perth.	
56	68	8 0	Waterford.	

Abies magnifica, Murr.—Is affected by cold in the same way and to the same extent as the last :—

Age, years.	Height.	Girth.	County.
	Feet.	Ft. In.	
13	25	2 2	Perth.
18	38	2 10	Dumfries.
30	50	3 6	Perth.
36	40	5 0	Lincoln.

Abies nobilis, Lind.—This tree is probably more planted for ornamental purposes than any other species of conifer. It is quite hardy, but wind and birds are rather apt to break its leading shoot :—

No.	Age, years.	Height.	Girth.	County.	Remarks.
		Feet.	Ft. In.		
1	17	42	3 4	Dumfries.	
2	22	48	6 11	Carmarthen.	
3	36	78	7 6	Gloucester.	
4	39	72	6 11	Perth.	Measured 1891.
5	45	72	6 4	Kent.	Measured 1891.
6	51	82	8 6	Perth.	Same tree as No. 4, measured 1903.
7	57	83	7 9	Kent.	Same tree as No. 5, measured 1903.
8	60	77	7 10	Ross.	Measured 1891.
9	72	81	9 0	Ross.	Same tree as No. 8, measured 1903. Has *lost its top since* 1891.

Abies nordmanniana, Spach.—Quite hardy, but specially liable to attack by *Chermes piceae* :—

No.	Age, years.	Height.	Girth.	County.	Remarks.
		Feet.	Ft. In.		
1	16	30	2 6	Forfar.	
2	20	48	3 6	Kirkcudbright.	
3	26	51	4 2	Dumfries.	
4	36	68	6 6	Perth.	Measured 1891.
5	48	75	8 9	Perth.	Same tree as No. 4, measured 1903.

Abies Pindrow, Spach.—Not hardy in all districts, but in many places it grows well :—

No.	Age, years.	Height.	Girth.	County.	Remarks.
		Feet.	Ft. In.		
1	24	43	4 0	Wicklow.	
2	30	42	3 6	Worcester.	
3	35	38	3 2	Wigton.	Measured 1891.
4	(?) 43	70	8 8	Perth.	
5	47	50	4 1	Wigton.	Same tree as No. 3, measured 1903.

Abies Pinsapo, Boiss.—Although this tree is somewhat exacting in its requirements as to climate, it grows fairly well in most districts of the British Isles. A hard frost, however, is apt to kill its leading shoot, when a malformed tree results :—

No.	Age, years.	Height.	Girth.	County.	Remarks.
		Feet.	Ft. In.		
1	18	25	1 10	Warwick.	
2	20	30	2 3	Northumberland.	
3	30	40	4 9	Wicklow.	
4	35	42	2 7	Haddington.	
5	40	60	6 6	Kent.	
6	46	62	9 0	Cambridge.	Measured 1891.
7	58	65	9 6	Cambridge.	Same tree as No. 6, measured 1903.

Abies webbiana, Lindl.—This tree is much more susceptible to hard frost than the former. Where the climatic conditions suit

it, it is one of the most beautiful and most rapid-growing of conifers :—

No.	Age, years.	Height.	Girth.		County.	Remarks.
		Feet.	Ft.	In.		
1	24	48	4	2	Wicklow.	
2	35	49	4	10	Argyle.	
3	41	52	6	3	Wexford.	Measured 1891.
4	50	51	8	0	Northumberland.	Measured 1891.
5	53	50	7	2	Wexford.	Same tree as No. 3, measured 1903. Lost its top 1895.
6	62	51	8	4	Northumberland.	Same tree as No. 4, measured 1903. Lost its top since 1891.

Araucaria imbricata, Pavon.—This tree has been very extensively planted for ornamental purposes, and proves resistant to ordinary winters almost everywhere :—

Age, years.	Height.	Girth.		County.
	Feet.	Ft.	In.	
18	32	2	4	Carmarthen.
27	40	4	0	Perth.
32	54	5	6	Perth.
36	47	4	9	Dumfries.
40	50	3	2	Perth.
51	44	5	10	Kildare.
61	68	8	0	Buckingham.

Cedrus atlantica, Manetti.—Scarcely affected by frost in any part of the British Isles. Like the other cedars, it grows well on chalk :—

No.	Age, years.	Height.	Girth.		County.	Remarks.
		Feet.	Ft.	In.		
1	18	18	3	6	Moray.	
2	22	40	5	0	Carmarthen.	
3	30	48	4	1	Tyrone.	
4	40	48	6	0	Northumberland.	
5	45	59	6	6	Haddington.	
6	50	50	5	0	Cambridge.	
7	60	70	7	6	York.	Measured 1891.
8	72	75	8	2	York.	Same tree as No. 7, measured 1903.

Cedrus Deodara, Loud.—This tree in Britain is one of the most uncertain of conifers. It is rather easily frosted, and there are many reports of its dying off when twenty or thirty years old :—

No.	Age, years.	Height. Feet.	Girth. Ft.	Girth. In.	County.	Remarks.
1	13	15	1	1	Galway.	
2	22	38	7	0	Carnarvon.	
3	27	51	4	0	Tipperary.	
4	32	49	5	4	Perth.	
5	40	55	7	6	Worcester.	
6	50	60	9	6	Kent.	Measured 1891.
7	60	70	7	6	York.	
8	62	73	10	9	Kent.	Same tree as No. 6, measured 1903.
9	63	102	8	5	Buckingham.	

Cedrus Libani, Loud.—Quite hardy in most districts, but thrives best on the warm chalks and gravels of the centre and south of England. Many specimens are over one hundred years old, and not a few are over two hundred years :—

Age, years.	Height. Feet.	Girth. Ft.	Girth. In.	County.
30	29	3	10	Sutherland.
40	47	4	0	Dumfries.
50	46	5	2	Perth.
66	78	9	0	Kilkenny.
111	109	12	2	Buckingham.
215	82	16	2	Derby.

Chamaecyparis lawsoniana, Parl.—Very susceptible to cold dry winds in the season of planting, but when once established is quite hardy. Abundantly planted, but chiefly for ornament :—

Age, years.	Height. Feet.	Girth. Ft.	Girth. In.	County.
12	22	2	1	Galway.
22	33	2	6	Ross.
30	47	4	5	Kent.
37	57	5	0	Kent.

Chamaecyparis nutkaënsis, Spach. (Syn. *Thujopsis borealis*, Hort.)—Perfectly hardy, and more graceful and impressive, as an ornamental tree, than *C. lawsoniana* :—

No.	Age, years.	Height. Feet.	Girth. Ft.	Girth. In.	County.	Remarks.
1	15	22	1	10	Banff.	
2	24	40	4	0	Wicklow.	
3	30	40	3	3	Queens.	
4	30	45	6	8	Ross.	
5	36	40	2	6	Lincoln.	Measured 1891.
6	48	47	3	4	Lincoln.	Same tree as No. 5, measured 1903.

Cryptomeria japonica, Don.—Quite hardy, and fairly abundant :—

No.	Age, years.	Height. Feet.	Girth. Ft.	Girth. In.	County.	Remarks.
1	22	30	6	3	Carmarthen.	
2	30	64	7	0	Cornwall.	
3	38	67	5	0	Wicklow.	Measured 1891.
4	50	62	5	11	Wicklow.	Same tree as No. 3, measured 1903, much broken by gale in Feb. 1903

Cupressus macrocarpa, Hartw.—This tree grows best near the sea, few trees resisting the action of sea spray better than this :—

No.	Age, years.	Height. Feet.	Girth. Ft.	Girth. In.	County.	Remarks.
1	20	48	6	0	Galway.	
2	30	48	5	0	Edinburgh.	
3	37	61	8	0	Kent.	Measured 1891.
4	40	64	9	3	Wicklow.	Measured 1891.
5	49	68	9	6	Kent.	Same tree as No. 3, measured 1903.
6	52	(?)	10	3	Wicklow.	Same tree as No. 4, blown down Feb. 1903, measured in June.

Larix leptolepis, Gord.—Quite hardy; in fact, less susceptible to spring frosts than *L. europaea*. Apparently also less liable to canker. Frequently planted during the past few years, but trees over ten years of age are rare. The oldest specimen appears to be at Tortworth, in the west of England, which is now about forty-one years old, 41½ feet high, and 3 feet 3½ inches in girth, at 4½ feet from the ground. Mr. Michie has been good enough to furnish me with the detailed measurements of two specimens planted at Balmoral in the spring of 1889:—

Year.	No. 1.—Height 20 ft. 7 in.; diameter at 4½ ft., 1 ft. 10¼ in.	No. 2.—Height 20 ft.; diameter at 4½ ft., 1 ft. 7 in.
	Growth in height (inches).	Growth in height (inches).
1902	18	15
1901	16	18
1900	14	9
1899	19	17
1898	Accident	18
1897		19
1896	23	21
1895	18	11
1894	19	24
1893	18	20

Libocedrus decurrens, Torr. (Syn. *Thuja gigantea*, Carr).—Quite hardy, and fairly abundant:—

No.	Age, years.	Height.	Girth.		County.	Remarks.
		Feet.	Ft.	In.		
1	13	10	0	8	Ross.	
2	23	23	3	6	Fife.	
3	26	40	2	6	Cambridge.	
4	35	37	6	3	Argyle.	
5	40	36	4	0	Lincoln.	Measured 1891.
6	45	63	6	0	Huntingdon.	
7	52	41	4	8	Lincoln.	Same tree as No. 5, measured 1903.
8	(?)	70	5	2	Buckingham.	

Picea Morinda, Link. (Syn. *Picea smithiana*, Boiss.).—This tree is a little fastidious as regards climate, growing distinctly better in the west than in the east of England, although there are some large specimens in the latter situation:—

No.	Age, years.	Height. Feet.	Girth. Ft. In.	County.	Remarks.
1	22	40	5 8	Carmarthen.	
2	30	50	4 0	Wicklow.	
3	35	55	3 4	Haddington.	
4	40	60	6 6	Waterford.	
5	45	71	8 0	Kent.	Measured 1891.
6	50	50	6 11	Perth.	
7	57	74	9 0	Kent.	Same tree as No. 5, measured 1903.
8	65	60	7 4	Linlithgow.	Grafted on Spruce.
9	70	76	8 0	Linlithgow.	

Picea orientalis, Carr.—Quite hardy, but not very abundant:—

No.	Age, years.	Height. Feet.	Girth. Ft. In.	County.	Remarks.
1	15	32	2 9	Lanark.	
2	27	34	4 6	Perth.	
3	35	50	3 3	Perth.	
4	40	40	3 0	Edinburgh.	
5	40	58	(?)	Carnarvon.	Measured 1891.
6	52	75	6 3	Carnarvon.	Same tree as No. 5, measured 1903.

Picea sitchensis, Carr. (Syn. *Abies Menziesii*, Lind.)—Perfectly hardy, and fairly abundant, especially in Scotland and Ireland:—

No.	Age, years.	Height. Feet.	Girth. Ft. In.	County.	Remarks.
1	18	45	3 0	Moray.	
2	22	49	7 8	Dumfries.	
3	27	75	4 10	Sligo.	
4	36	77	7 4	Perth.	
5	46	96	11 0	Perth.	Measured 1891.
6	56	110	10 0	Waterford.	Measured 1891.
7	58	111	13 4	Perth.	Same tree as No. 5, measured 1903.
8	58	90	9 0	Northumberland.	Measured 1891.
9	68	106	11 9	Waterford.	Same tree as No. 6, measured 1903.
10	70	100	10 0	Northumberland.	Same tree as No. 8, measured 1903.

Pinus excelsa, Wall.—Requires the milder districts of Britain, but there it grows well :—

No.	Age, years.	Height.	Girth.		County.	Remarks.
		Feet.	Ft.	In.		
1	7	16	0	10	Perth.	
2	24	40	3	6	Wicklow.	
3	30	60	6	1	Kirkcudbright.	
4	40	49	5	2	Perth.	
5	48	60	8	0	Kent.	Measured 1891.
6	60	50	7	6	Worcester.	Measured 1891.
7	60	64	9	0	Kent.	Same tree as No. 5, measured 1903.
8	72	87	8	0	Worcester.	Same tree as No. 6, measured 1903.
9	74	90	8	2	Bucks.	

Pinus insignis, Loud.—Makes magnificent growth in the south and west of England, and throughout the whole of Ireland. Not hardy enough for general adoption in Scotland and England :—

No.	Age, years.	Height.	Girth.		County.	Remarks.
		Feet.	Ft.	In.		
1	8	14	0	9	Tyrone.	
2	25	56	6	6	Galway.	
3	32	82	10	0	Wicklow.	
4	40	74	10	8	Galway.	Measured 1891.
5	45	62	10	0	Kent.	
6	50	72	7	6	Limerick.	Measured 1891.
7	52	90	14	3	Galway.	Same tree as No. 4, measured 1903.
8	62	87	9	6	Limerick.	Same tree as No. 6, measured 1903.
9	74	82	13	3	Buckingham.	

Pinus Jeffreyi, Balf.—Perfectly hardy. Much commoner in Scotland than in other parts of Britain :—

Age, years.	Height.	Girth.		County.
	Feet.	Ft.	In.	
16	17	1	2	Perth.
26	40	3	9	Fife.
35	50	3	6	Fife.

Pinus lambertiana, Dougl.—Very little planted, but appears to be quite hardy and to grow well :—

No.	Age, years.	Height.	Girth.		County.	Remarks.
		Feet.	Ft.	In.		
1	40	46	6	0	Perth.	
2	43	50	6	8	Lincoln.	Measured 1891.
3	55	57	7	6	Lincoln.	Same tree as No. 2, measured 1903.
4	60	82	9	5	Buckingham.	Has grown 11 ft. in height in last 10 years.

Pinus Laricio, Poir.—British foresters draw a much sharper line of distinction between this tree and *P. austriaca*, Hoess., than appears to be the case with Continental foresters. *P. Laricio* has been a good deal planted for ordinary commercial purposes, especially on strong land and chalk, where it shows more rapid growth than the Scots Pine. It is credited with resisting the attack of rabbits better than most trees. Perfectly hardy :—

No.	Age, years.	Height.	Girth.		County.	Remarks.
		Feet.	Ft.	In.		
1	22	40	3	10	Moray.	
2	25	45	3	0	Kirkcudbright.	
3	35	50	5	0	Tyrone.	
4	40	79	5	9	Cornwall.	Measured 1891.
5	52	76	8	0	Cornwall.	Same tree as No. 4, measured 1903.
6	70	75	7	6	Worcester.	
7	74	102	10	3	Buckingham.	Has grown 6 ft. in height in last 10 years.

Pinus monticola, Dougl.—Perfectly hardy and grows rapidly, but so much affected by *Cenangium abietis* as to be threatened with extermination in many districts. Apparently this disease has spread with great rapidity during the past few years, there being no report of its ravages in the many communications that Mr. Dunn received for the Conifer Conference in 1891 :—

No.	Age, years.	Height.	Girth.	County.	Remarks.
		Feet.	Ft. In.		
1	15	32	1 7	Perth.	
2	22	60	3 10	Moray.	
3	30	70	5 3	Perth.	
4	39	71	5 11	Perth.	Measured 1891.
5	51	83	7 1	Perth.	Same tree as No. 4, measured 1903.

Pinus Pinaster, Sol.—This is but little planted. It is only near the sea that it grows well, but it is of good dimensions even in the N.E. of Scotland :—

Age, years.	Height.	Girth.	County.
	Feet.	Ft. In.	
40	43	6 0	Aberdeen.
80	68	10 0	Worcester.
92	77	9 10	Worcester.

Pinus ponderosa, Dougl.—Perfectly hardy and frequently met with :—

Age, years.	Height.	Girth.	County.	Remarks.
	Feet.	Ft. In.		
18	30	1 4	Carmarthen.	
24	36	2 0	Wicklow.	
30	44	3 2	Dumfries.	
35	48	3 0	Fife.	
45	50	4 6	Haddington.	
74	98	8 5	Buckingham.	Seed sent home by Douglas in 1827. Has grown 13 ft. in height in last 10 years.

Pseudotsuga Douglasii, Carr.—Of all the exotic conifers this appears to be by far the most important for British conditions. It grows best in Ireland and the west of Great Britain, where the air holds the maximum amount of humidity, but it also thrives well wherever it is sheltered from strong prevailing winds, provided the soil is sufficiently deep. It shows a marked aversion to chalk. Of the two chief varieties—the green from

Oregon and the glaucous from Colorado—the green appears to be by far the more important for British conditions. It grows much faster, and yet yields better timber than the other, while although a little more delicate, it is sufficiently hardy for all practical purposes :—

No.	Age, years.	Height. Feet.	Girth. Ft. In.	County.	Remarks.
1	12	24	2 5	Galway.	
2	18	43	4 0	Moray.	
3	22	62	7 0	Carmarthen.	
4	30	80	6 0	Moray.	
5	40	100	7 6	Kings.	
6	46	92	7 1	Perth.	Measured 1891.
7	58	103	9 0	Perth.	Same tree as No. 6, measured 1903.
8	61	120	10 10	Buckingham.	From seed sent home by Douglas in 1827, measured 1891.
9	73	127	11 6	Buckingham.	Same tree as No. 8, measured 1903.

In the case of the Douglas fir I am able to give some figures from a wood (Taymount) of eight acres planted with four-year-old plants in the spring of 1860 on the estate of the Earl of Mansfield, about seven miles from Perth, in central Scotland.

Professor Schlich puts the quality of the locality in the first class, but in doing so I think he estimates somewhat too highly. My reasons for thinking so are two-fold : (1) the impression gathered from an inspection of the soil is that there are many more suitable situations, and (2) the height-growth recorded in the table above is in many cases better than that at Taymount. The planting was done in squares, the Douglas firs being placed 12 feet apart, and the interspaces filled with Larch, so that the trees stood 6 feet apart. An acre thus contained, theoretically, 1,210 plants, of which 908 were Larch and 302 Douglas firs. By the year 1880 the Larches had all been removed, and in 1887 the Douglas firs were thinned, so that only 202 remained per acre. The Douglas firs (600–700) removed from the eight acres realised by auction sale £34. There can be no doubt that too many trees were removed at this time. What with too wide planting to begin with, and too much thinning in 1887, the trees remaining in the latter year

were very rough and branchy, and about 1896 all the branches to a height of 30 to 35 feet were pruned off. No thinning has taken place since 1887.

On July 20th, 1888, Professor Schlich* made a careful estimate of the volume of the growing stock. By counting and measuring the diameter of all the trees on $\frac{4}{10}$ acre, he arrived at the following result, in terms of an acre :—

Diameter at 4½ ft. from Ground.	Number of Trees of each Diameter.	Total Sectional Area at 4½ ft.	Diameter at 4½ ft. from Ground.	Number of Trees of each Diameter.	Total Sectional Area at 4½ ft.
Inches.		Square Feet.	Inches.		Square Feet.
4	3	·26	12	20	23·56
5	12	1·64	13	35	32·26
6	3	·59	14	17	18·17
7	7	1·87	15	20	24·54
8	10	3·49	16	8	11·17
9	17	7·51	17	2	3·15
10	15	8·18			
11	33	21·78	Total	202	158·17

The average sectional area is thus ·783 ft., equal to a diameter of 12 inches.

An average tree was felled, and gave the following dimensions :—

Diameter at 4½ ft. from ground	11·78 inches.
Sectional area...	·757 sq. ft.
Total height	60 feet.

The tree was found to measure 3 inches in diameter at 48 feet from the ground, and there it was cut through. It was then divided into eight sections of 6 feet each, each of which was measured with the following result :—

No. of Section.	Length of Section.	Mean Diameter of Section.	Volume of Wood in each Section.
	Feet.	Inches.	Cubic Feet.
1	6	12·5	5·11
2	6	10·0	3·27
3	6	9·5	2·95
4	6	8·5	2·36
5	6	7·0	1·60
6	6	6·5	1·38
7	6	5·0	0·82
8	6	3·5	0·40
Total	48	—	17·89

* *Trans. Royal Scottish Arboricultural Society*, Vol. xii, p. 226.

The top and branches measured 50 cubic feet, say—

50 × ·15 = 7·5 cubic feet of solid wood.

These figures are calculated by Dr. Schlich to give a total volume of wood, exclusive of top and branches, of 3,738 cubic feet per acre. The trees being four years old when planted, had reached an age of nearly 32 years on July 20th, 1888, so that the increment, apart from thinnings and branches, was 117 cubic feet *per acre per annum*.

By the courtesy of the Earl of Mansfield I have been able to bring the statistics of this interesting wood up to date by measurements taken by Mr. Pitcaithley on June 22nd, 1903. Two typical areas each of $\frac{1}{10}$ acre were selected and the trees counted and measured. The results are given in the accompanying table:—

Sample Area No. 1.

No. of Tree.	Diameter at 4½ ft.	Sectional Area at 4½ feet.
	Inches.	Square Inches.
1	11·1	96·8
2	12·0	113·1
3	12·7	126·7
4	13·7	147·4
5	15·0	176·7
6	15·3	183·8
7	15·6	191·1
8	15·9	198·6
9	18·1	257·3
10	18·3	263·0
11	18·5	268·8
12	18·6	271·7
13	18·9	280·5
14	19·3	292·5
15	19·6	301·7
16	19·9	311·0
17	20·1	317·3
18	21·8	373·2

Total Sect. Area in sq. in.	4,171·2
,, ,, ,, ,, sq. ft.	29·0
,, ,, ,, Per Acre	290·
Average Sect. Area per tree in sq. in.	231·7
Do. in sq. ft.	1·6

Sample Area No. 2.

No. of Tree.	Diameter at 4½ feet.	Sectional Area at 4½ feet.
	Inches.	Square Inches.
1	6·5	33·2
2	7·0	38·5
3	7·2	40·7
4	8·0	50·3
5	9·6	72·4
6	10·8	91·6
7	12·0	113·1
8	12·3	118·8
9	12·4	120·8
10	13·5	143·2
11	14·5	165·1
12	14·8	172·0
13	15·0	176·7
14	15·8	196·1
15	15·9	198·6
16	16·5	213·8
17	16·9	224·3
18	17·0	227·0
19	17·4	237·8
20	18·0	254·5
21	18·1	257·3
22	18·5	268·8
23	18·6	271·7
24	19·9	311·0
25	20·5	330·1

Total Sec. Area in sq. in.	4,327·4
,, ,, ,, ,, sq. ft.	30·0
,, ,, ,, Per Acre	300
Average Sect. Area per tree in sq. in.	173·1
Do. in sq. ft.	1·2

Average sectional area per tree on both sample Areas = 197·6 sq. inches.

,, ,, ,, ,, ,, ,, ,, ,, ,, = 1·372 sq. feet.

On area No. 1 there were 18 trees, and on area No. 2, 25 trees, the mean for the whole wood being probably not less than 210 per acre. In order to facilitate accurate comparison with Dr. Schlich's figures of 1888 we may assume the same average number of trees per acre, namely, 202. In the case of area No. 2 four of the trees were exceptionally small, and in a wood planted sufficiently close in youth they would certainly have disappeared in the thinnings. The total sectional area of the stems at 4½ feet was 290 and 300 feet respectively per acre, mean say 295. From these figures the mean diameter of the trees of area No. 1 works out at 17·2 inches (girth, 4 feet 6 inches); while in the case of area No. 2 it is 14·8 inches (girth, 3 feet 10½ inches). The mean diameter may be put at 15·9 inches, equal to a girth of 4 feet 1¾ inches. In 1888 Dr. Schlich found the average diameter to be 12 inches, his sample tree being a quarter of an inch less.

Some trees having last winter been blown down towards the margin of the wood, Mr. Pitcaithley measured a typical one in 6 feet sections, the details of which are given below. The total length was 80 feet, the diameter of 3 inches being reached at 71½ feet. The true cubical contents work out at 58·93 feet, or 46·76 feet calculated by quarter-girth measure:—

NO. 1.—SAMPLE DOUGLAS FIR, MEASURED 1903.

No. of Section.	Length of Section.	Mean Diameter of Sections.	Volume of Wood in each Section.	Mean Circumference of Sections.	Volume of Wood by Quarter-girth Measure.
	Feet.	Inches.	Cub. Feet.	Ft. In.	Cub. Feet.
1	6	18·0	10·60	4 8¼	8·31
2	6	16·2	8·59	4 3	6·77
3	6	15·3	7·66	4 0	6·00
4	6	14·5	6·88	3 9¼	5·41
5	6	13·5	5·96	3 6¼	4·68
6	6	12·6	5·19	3 3¼	4·08
7	6	11·6	4·40	3 0¼	3·45
8	6	10·5	3·61	2 9	2·84
9	6	9·2	2·77	2 4¾	2·15
10	6	7·6	1·89	2 0	1·50
11	6	5·5	·99	1 5¼	0·77
12	5½	3·6	·39	0 11¼	0·30
Total	71½	—	58·93	—	46·76

As, however, this tree was rather larger than the average, girthing, as it did at breast height, 4 feet 7 inches (17·5 inches diameter), Mr. Pitcaithley was good enough to select a normal standing tree, girthing 4 feet 1 inch (15·6 inches diameter, 1,327 square feet section area) at 4½ feet from the ground, and this was duly measured in 6 feet lengths. Its total height was 83 feet, the point of 3 inches in diameter being reached at 75 feet. The true cubical contents, neglecting top and branches, were found to be 50·25 feet, or, calculated according to English measure, 39·49 feet. With 202 trees to the acre—and there are probably rather more than less—this gives the enormous total of 10,150 cubic feet, or, by quarter-girth measure, 7,977 cubic feet.

No. 2.—SAMPLE DOUGLAS FIR, MEASURED 1903.

No. of Section.	Length of Section.	Mean Diameter of Sections.	Volume of Wood in each Section.	Mean Circumference of Sections.	Volume of Wood by Quarter-girth Measure.
	Feet.	Inches.	Cubic Feet.	Ft. In.	Cubic Feet.
1	6	17·52	10·04	4 7	7·88
2	6	15·29	7·64	4 0	6·00
3	6	13·54	6·00	3 6½	4·70
4	6	12·66	5·24	3 3¾	4·16
5	6	12·02	4·73	3 1¾	3·71
6	6	11·31	4·19	2 11½	3·37
7	6	10·35	3·51	2 8½	2·73
8	6	9·39	2·89	2 5½	2·28
9	6	8·44	2·33	2 2½	1·81
10	6	7·16	1·68	1 10½	1·31
11	6	5·89	1·14	1 6½	0·88
12	6	4·62	·70	1 2½	0·54
13	3	3·13	·16	0 9¾	0·12
Total ...	75	—	50·25	—	39·49

If the volume per acre be deduced from the equation—

$$\frac{\text{Volume per acre}}{\text{Volume of sample tree}} = \frac{\text{Sectional area per acre}}{\text{Sectional area of sample tree}},$$

$$\text{we get, Volume per acre} = \frac{295 \times 50·25}{1·327} = 11,171 \text{ cubic feet.}$$

Seeing that this was the method adopted by Dr. Schlich, we may accept the last result for purposes of comparison. Deducting the volume per acre in 1888 (3,738 cubic feet) from the volume in 1903 (11,171 cubic feet) we get the lmost

incredible result that 7,433 cubic feet of wood have been added per acre during the past fifteen years, an average increase during that period of 495 cubic feet per acre per annum. When, however, it is seen that even the smaller of the two sample trees contains about three times as much timber as the sample tree of 1888, and bearing in mind the fact that no trees have been removed since that year, the result becomes more easy of credence.

During the same period the average height has increased from 60 to 83 feet, the point of 3 inches diameter being reached at 48 feet in 1888 and 75 feet in 1903.

Taking the age of the wood (forty-seven years) from the time the seed was sown (1856), we have a mean height-growth of 1·77 feet per annum, and a mean annual increase in volume per acre of 238 cubic feet.

The contents of the two sample trees are calculated both as to true contents and also by the English system of quarter-girth measure. In the case of No. 1, the true volume was 58·93 cubic feet, while the quarter-girth contents were 46·76 cubic feet, so that to reduce the former to the latter it is necessary to deduct 20·65 per cent.; while to convert quarter-girth measure into true contents, it is necessary to add 26·03 per cent.

In the case of tree No. 2, the corresponding percentages are 21·41 and 27·25. For ordinary purposes, therefore, it will suffice to add a fourth in converting quarter-girth contents into continental or calliper measure; while to convert the latter into the former a fifth must be deducted. Dr. Schlich's sample tree contained about 14 cubic feet quarter-girth measure, so that an acre carried—

$$14 \times 202 = 2,828 \text{ cubic feet.}$$

The smaller of the sample trees measured this year contained 39·42 cubic feet by the same system of measurement, therefore—

$$39·49 \times 202 = 7,977 \text{ cubic feet per acre.}$$

In 1888 Dr. Schlich calculated the "form figure" of the Douglas fir at the age of thirty-two years to be ·39, and anticipated that it would gradually decline.* This, however, has not proved

* *Loc. cit.* p. 237.

to be the case, for in the case of sample tree No. 1 the form figure works out at—

$$\frac{\text{Volume}}{\text{Sectional area} \times \text{height}} = \frac{58{\cdot}93 \times 12 \times 12 \times 12}{240{\cdot}53 \times 80 \times 12} = {\cdot}441$$

while in the case of No. 2 it is

$$\frac{50{\cdot}25 \times 12 \times 12 \times 12}{191{\cdot}13 \times 83 \times 12} = {\cdot}456$$

If the less favourable of these form figures, namely, ·441, be used to calculate the true timber contents from the mean of the two sample areas, we get—

$$295 \times 80 \times {\cdot}441 = 10{,}407 \text{ cubic feet}$$

which is very near what we came to (10,150 cubic feet) by multiplying the volume of the smaller sample tree (50·25 cubic feet), by the assumed number of trees per acre (202). As, however, I believe there are, on an average, 210 trees per acre, the calculation would probably be more correct thus—

$$50{\cdot}25 \times 210 = 10{,}552 \text{ cubic feet}$$

which differs from the result (10,407 cubic feet) got by using the form figure by less than 1½ per cent.

These figures show that in the Douglas fir we have a tree of extraordinary value, and although it is a little fastidious both as to soil and climate, there are doubtless large tracts where its cultivation will prove in the highest degree remunerative.

Sequoia gigantea, Decais. (Syn. *Wellingtonia gigantea*, Lind.) —This tree is perfectly hardy, at the worst being merely slightly browned by cold winds in winter and spring. Few trees grow so well on the high exposed chalk hills in the south of England. It is very extensively planted throughout the whole country. Many well-grown specimens have been raised from cuttings, a form of propagation that seems to interfere little, if at all, with height-growth. At Orton, in the county of Hunts., there is an avenue 700 yards long, containing about 300 trees, many of which were raised from cuttings about 1853, and planted out in the autumn of 1859 and the spring of 1860. The trees are now 60–80 feet high, and have a girth in many cases of over 10 feet at breast-height :—

No.	Age, years.	Height.	Girth.		County.	Remarks.
		Feet.	Ft.	In.		
1	18	38	5	3	Ross.	
2	22	53	10	5	Carnarvon.	
3	28	72	8	0	York.	
4	30	72	10	6	Kent.	Measured in 1891.
5	34	80	8	6	Tipperary.	Measured in 1891.
6	42	81	12	6	Kent.	Same tree as No. 4, measured 1903.
7	46	92	11	3	Tipperary.	Same tree as No. 5, measured 1903.

Sequoia sempervirens, Endl. (Syn. *Taxodium sempervirens*, Lamb.)—Not so hardy as *S. gigantea*, but grows well in many districts. Apt to become very brown in hard winters, though it is seldom killed or even crippled :—

No.	Age, years.	Height.	Girth.		County.	Remarks.
		Feet.	Ft.	In.		
1	20	40	5	5	Queens.	
2	22	48	5	0	Carmarthen.	
3	26	53	7	0	Antrim.	
4	32	60	7	9	Perth.	Measured 1891.
5	36	73	8	9	Gloucester.	
6	40	75	13	0	Cornwall.	Measured 1891.
7	43	74	4	6	Perth.	Measured 1891.
8	44	80	10	0	Perth.	
9	47	60	11	0	Kent.	Measured 1891.
10	51	51	9	8	Kildare.	
11	52	75	14	9	Cornwall.	Same tree as No. 6, measured 1903.
12	55	80	5	0	Perth.	Lost its leader, 1897. Same tree as No. 7, measured 1903.
13	58	114	10	6	Buckingham.	The Variety *pendula*.
14	59	68	12	0	Kent.	Same tree as No. 9, measured 1903.

***Thuja gigantea*, Nutt. (Syn. *T. Lobbi*, Hort.)—Quite hardy and much planted, suffers a good deal from *Pestalozzia funerea* :—**

No.	Age, years.	Height.	Girth.		County.	Remarks.
		Feet.	Ft.	In.		
1	18	41	2	4	Lanark.	
2	26	62	5	2	Antrim.	
3	30	65	6	0	Kent.	Measured 1891.
4	40	52	7	8	Kildare.	
5	42	69	7	4	Kent.	Same tree as No. 3, measured 1903.
6	(?)	85	5	10	Buckingham.	Has grown 13 ft. in height in last 10 years.

Tsuga albertiana, Kent. (Syn. *T. mertensiana* Carr.)—Perfectly hardy, and much planted. The fifty-year-old tree mentioned below has borne large quantities of excellent seed during the past twenty years :—

No.	Age, years.	Height.	Girth.		County.	Remarks.
		Feet.	Ft.	In.		
1	18	57	4	0	Perth.	Measured in 1891.
2	23	68	4	7	Perth.	
3	25	69	4	3	Kirkcudbright.	
4	30	85	6	6	Perth.	Same tree as No. 1, measured 1903.
5	30	52	5	4	Perth.	Measured in 1891.
6	30	68	4	3	Kent.	Measured in 1891.
7	38	72	5	9	Perth.	Measured in 1891.
8	42	67	8	2	Perth.	Same tree as No. 5, measured 1903.
9	42	72	5	9	Kent.	Same tree as No. 6, measured 1903.
10	50	100	7	8	Perth.	Same tree as No. 7, measured 1903.

Tsuga canadensis, Carr.—Quite hardy, but not nearly such a fast-growing tree as the last, and not so much planted :—

Age, years.	Height.	Girth.		County.
	Feet.	Ft.	In.	
22	35	3	0	Wicklow.
45	30	7	0	Wicklow.
80	42	10	6	Edinburgh.

POTATO DEVELOPMENT BY FARMERS AND GARDENERS.

The rapid development of potatoes from a small stock is of special interest now, because during the past two years farmers have discovered that, provided they can get a small stock of a new variety possessing sufficient merit, they have at their command the means of making a larger return on a given capital than has hitherto been regarded as possible. The large sums of money made by developing the Northern Star potato are certainly unprecedented in the annals of farming. Moreover, those who have participated in this profitable work of development have rendered a service to the potato-growing community, as it has hastened the period when a great disease-resisting variety can be obtainable by the general grower. It will be three or four more years before the price of this variety will fall low enough to be sold for culinary purposes, but it would have been much longer had a special system of development not been adopted. There are 1,200,000 acres of potatoes grown in the United Kingdom—mostly with varieties which readily succumb to disease, and therefore giving far less profit than if they were sound. Anything, therefore, which conduces to the more rapid development of disease-resisting varieties must be for the good of the grower, and also for the consumer. The strong disease-resisting powers of the Northern Star have been clearly demonstrated in all parts of the country during the past two years, and the best proof of the regard in which this variety is held is obtained from the fact that all the largest growers have recognised the necessity of growing it. The large amount of disease in the country has, of course, greatly emphasised the necessity for getting up a stock of new varieties which possess disease-resisting properties in a marked

degree. There is little doubt that in the future, when a new variety possessing very special merit is brought forward, every effort will be made to develop it rapidly; and in this article an account is given of methods which can be adopted to hasten its development.

The experiments which have been carried out for nearly a century on cut *versus* uncut sets have generally shown that there is a stronger crop from uncut sets; and the popular mind has accepted this view, which within certain limits is correct. A whole potato is encased in a skin which retains moisture; moreover, many insects, such as wireworms, eelworms, and other scavenging insects do not so readily attack an unwounded set as one which has been cut, or is in any way decaying. A cut set is at once acted upon by surrounding conditions, and decay immediately sets up about the cut portion. Where, therefore, it is planted under conditions where it has to make a struggle for existence, it is not so favourably placed as is one which has no wound. When a tuber is cut so as to provide a large number of sets, the sets are small; therefore, so far as possible, the struggle to establish a plant must be facilitated by all reasonable means. The experience of the last few years shows that this may be done on a large scale at a moderate cost. When in the previous article* we urged that it was not a matter of overwhelming difficulty to cut each eye from a potato, and pot it separately so to give it favourable opportunities to produce a plant, there were those who expressed the contrary view, and maintained it was impossible for it to be done except on a limited scale. To confirm our expressed views we last spring had 50,000 eyes cut from 14 cwt. of tubers, and planted in as many pots. The plants grew with a very small percentage of misses, and at the present time we have nearly eight acres growing vigorously in the field. Few who have seen the crops would previously have believed that the fine plants now growing could have been raised from other than a whole set of ordinary seed size.

As a means of placing this work before others so that they may practice it, we give a detailed description of our

* *Journal of the Board of Agriculture*, March, 1903, Vol. ix., p. 482.

methods at the Manor Farm, Ham. Cutting out each eye and potting was commenced at the beginning of April, though in ordinary circumstances it might be begun earlier. Two reasons led to this—first, the eyes were backward ; and, second, it was thought desirable not to be too early for fear of spring frosts after they were transplanted into the field. No large buildings or sheds were available, so an outdoor camp had to be devised. A piece of ground was levelled and the pots were placed in ranges about ten pots wide with narrow pathways between. Some loose mould was spread over the ground, and 3-in. pots were set in this as closely as possible to one another. The north sides and the ends were made of walls of straw about 4 ft. 6 in. high, but on the south side only about 2 ft. 6 in., so as to admit sun. A range of 4 in. by 3 in. stakes was set up the middle, standing about 3 ft. above ground. Along this was stretched a stout wire. Cross strands of wire were run from side to side over the middle row of piles, and these were attached at either side to a row of piles about 15 in. high, so that when the covers were put on they had a good shoot to clear the rainfall. The sheets were 12 ft. wide, and were fitted with rings so that they were easy to furl. In sunny weather it is well to admit all possible sunshine, and a ready means of furling and covering is desirable.

Having put down the pots, into which small pieces of crocks were placed, and set up the shelter, cutting was commenced. At the same time earth was finely sifted and placed in the pots, after being mixed with a small quantity of superp hosphateof lime. As fast as the sets were cut they were sprinkled with slaked lime, and straightway potted. With such small sets it is advisable to place the eye upwards. The pots were nearly filled, and the earth very lightly pressed ; a hole was opened with a knife and the set put in ; subsequently a little loose mould was sprinkled over to fill the pots.

Beyond regulating the cover night and morning, little attention is needed beyond an occasional light watering, just sufficient to maintain a slight moisture, which is largely regulated by the power of the sun.

The planting out was done as the plants became big enough. A good tilth was prepared in an ordinary field, and lines were

marked out by drill coulters set 32 in. apart. The plants were placed about 30 in. from one another in the rows. In carting the pots to the field, racks made on light frames, with divisions just narrow enough to prevent the pots from slipping through, were used, and each rack carried 100 pots. These are convenient also for carrying the pots in the field to lay out for planting. The racks were long enough to reach across the carts, one layer being placed in the bottom, and another across the raves, so that it was easy to take 1,000 plants to the field at once. After the plants were laid out, the planters, each with a garden trowel, wrenched out a hole in the loose earth, and placed the plant with all the soil from the pot adhering (being well held together by the roots) into the hole. Planting was then completed, and the subsequent cultivation did not differ from ordinary practice. The value of growing in pots was well illustrated, for practically every one grew, while in a small piece not potted there was a considerable percentage of misses. So robust was the growth from these plants raised from single eyes that the large amount of room allowed proved to be none too great for their development.

By taking out each eye separately it is not difficult, with careful management, to raise 100 lb. of potatoes from 1 lb. of tubers. This, however, is not by any means the limit to which development may be extended. The eye of a potato generally contains two to four shoots, and it is possible to make use of all of these. If a potato is sprouted as in the ordinary course of "boxing," and the shoots are allowed to grow three or four inches in length, these may be pulled off, and if carefully planted will produce plants.

The development of a large stock of potatoes from a single tuber can therefore be quickly carried out, and it will tend greatly to growers' benefit when they realise how little expense need be incurred in getting new stocks, even though the cost for the initial few pounds at first sight appears to be great. The most expensive action on the part of a grower is the growing of varieties which have been cultivated so long as to have lost their original vigour, and have become subject to disease. The two last years have very strongly proved this.

W. J. MALDEN.

FOWL CHOLERA.

The Irish Department of Agriculture and Technical Instruction have recently issued a leaflet (No. 25) dealing with fowl cholera. As the symptoms as well as the methods of treatment and prevention of this disease are practically the same as those of contagious or bacterial enteritis, the leaflet deals with both diseases for the purpose of simplicity.

Treatment of diseased birds is rarely successful, but it is possible that many outbreaks would be checked and much trouble and annoyance saved if, on the first appearance of the disease, affected birds were killed and prompt action taken to secure a thorough disinfection of the premises. The disease is very contagious, and, in most cases, fatal. The ravages of the disease are most apparent amongst flocks of laying hens, those of all ages being affected ; but the younger ones are, perhaps, more susceptible. Other classes of poultry, viz., turkeys, ducks, and geese are, however, not immune.

Cholera is due to the presence of a germ, and, as with all such diseases, during treatment the chief efforts should be directed towards an improvement of the sanitary conditions. Stagnant water, sewage, and drainage from manure heaps, or filth of any kind, should not be allowed to collect in places to which fowls have access, as such conditions render the birds unhealthy, and are always a possible source of contamination.

The disease usually appears during the spring, and it may be due to the introduction of fresh fowls from contaminated stocks ; or the germs may be carried by dogs or other animals, or even on the clothes or boots of persons who travel direct from an infected run to a place where the disease has hitherto been unknown. Wild birds may also serve as active agents in spreading the disease. The most common source of infection is

eating blades of grass and other food which have come in contact with the droppings of diseased fowls; or by drinking contaminated water. The bodies of all birds which die from the disease should either be burnt or buried deeply and covered with quicklime; but burning is strongly recommended.

The symptoms of cholera are as follows :—

At first the number of affected birds is limited; perhaps two or three in the flock are one evening noticed to be listless, ruffled in plumage, refusing to eat, and drinking large quantities of water. If carefully watched these birds are seen to be affected with diarrhœa; and this is the most important outward symptom. The excrement is of a characteristic yellowish colour, though sometimes it may be more or less greenish. The comb and wattles may be either pale, or dull purple in colour; more often the latter. These are the first signs that will be noticed by an observant poultry keeper. If, however, only one bird is at first attacked, it may escape detection while ailing, and one or more birds lying dead under the perches in the morning, with a quantity of the unpleasant yellowish or greenish coloured excrement near them, may be the first indication of the existence of the disease on the premises. During the day other birds will exhibit the symptoms described above, and in the last stages of ey will be found showing signs of weakness, and, perhaps, which ness, until finally death occurs. Some birds may live for generally ce days after they are seen to be affected, during this use of all of little or no food, remaining inert, drinking large course of " boxwater, frequently voiding excrement characteristic or four inches in le eventually dying from exhaustion. Cases of planted will produce known, but where outbreaks are caused by

The development ot ns of the disease the victims usually die in tuber can therefore be ours after they are affected.

greatly to growers' benefit in view when combating this disease need be incurred in getting birds, *disinfection* of houses, runs, &c., the initial few pounds at fings. Immediately isolate any fowls most expensive action onns of the disease, and give nutritious varieties which have beersuch as boiled rice, bread, pollards, or original vigour, and havsoft paste with boiled milk. The runs and last years have very str be thoroughly disinfected. A 5 per cent acid is suitable for this purpose, but any

other reliable disinfectant could be used. It is probable that a 10 per cent. solution of copper sulphate would give excellent results, but the fowls would be poisoned if allowed to drink any of the liquid. The question of removing all droppings of diseased fowls and afterwards disinfecting the ground cannot be too strongly emphasised, as the disease is undoubtedly transmitted to healthy fowls chiefly through the neglect of such precautions. Clean out the fowl-house and lime-wash the walls, perches, nestboxes, and all the fittings, using hot lime-wash, to which 1 pint of paraffin or ¼ lb. carbolic acid has been added to each gallon of the liquid. As long as any traces of the disease remain, keep the house daily cleaned out and disinfected. The cleanings from the houses and runs should not be thrown on the manure heap, but should be so disposed of that fowls cannot have access to them. Feed the fowls only in troughs, and provide suitable vessels for water, all of which should be frequently scalded with boiling water. A few drops of tincture of iron may be added to the drinking water ; this acts as a tonic. If the diet of the fowls largely consists of Indian meal or Indian corn, substitute pollard, ground oats, or bran and wheat, or barley, with the object of improving the general tone of the system.

After an outbreak, all the healthy fowls should, where practicable, be removed on to fresh ground for at least six months. For instance, if the outbreak occurs on a farm, one or more portable houses should be procured, and the fowls kept quite away from the farmyard in a pasture field, where the land is clean. Where this system of poultry keeping is once fairly tried it may safely be assumed that it will afterwards be strictly adhered to, for, provided overcrowding is avoided, it is not only more healthy, but more profitable than any other. In removing the fowls from the farmyard to new ground great care should be exercised in selecting only those which show no signs of disease, and as an additional precaution the new house should frequently be disinfected. When this plan is adopted a thorough clearance from the farmyard should be made, no ducks, chickens, or turkeys being kept there in the interval. Freshly-slaked lime should be scattered everywhere over the old run, and, where possible the contaminated ground should be cultivated and a

crop grown. In a case where it is impossible to change the fowls on to new ground, and where the disease has been very pronounced, it is advisable to kill off all the fowls on the premises and give the land a rest for at least six months, adopting the measures recommended above for purifying the run.

Newly acquired fowls should not be allowed to run at once with the general stock, but should be kept confined for about ten days, to see if any traces of disease are developed, and to prevent risk of contamination.

Poultry keepers should do their utmost to guard against the introduction of this disease, as once it appears the losses caused are almost incalculable, and the best way of attaining this end is by keeping the fowls under perfect conditions of health.

FEEDING OF POULTRY.

There is a widespread belief that poultry keeping can never be made a great industry in the United Kingdom by reason of the large amount of labour entailed and the great cost of up-keep in the way of food.

No idea can be more incorrect, though there is at present an unfortunate tendency in many quarters to look upon poultry keeping as a sort of hobby, and, moreover, there is a serious wastage in the matter of food and labour.

So far as cost of keep is concerned co-operation in buying will work wonders, while as to the saving of labour experience is all that is necessary.

It is much more important to determine what is the proper kind of food to give, and it should be remembered that in order to make the largest possible profit one must feed for a specific purpose, viz., either for eggs or for flesh; not, as many do, merely with a view to keeping one's birds alive at the smallest cost and with the least possible expenditure of trouble.

In fact, if good laying hens are desired, they must be selected and fed with great care, and as in every dozen marketable eggs there is about one pint of water, it must be remembered that each hundred laying hens will require not less than 16 quarts of water every day.

In this connection it should be noted that impure water is liable to make the eggs taste strong, and, especially on farms where there are often dead birds lying about, dirty water may contain the germs of disease. It is therefore absolutely necessary that only fresh, pure water be given to poultry.

It should also be remarked that whereas an ordinary hen of the lighter varieties (such as Leghorns or Minorcas) requires daily from 3¼ to 3½ oz. of food when laying, if not laying she will need only about 2¾ oz. daily. During the moulting season, however, the bird may be allowed as much food as she will eat clean. Of course, the more active a bird may be the more food she will require in proportion to her weight.

Further, it must be remembered that in order to keep birds in the best possible state of health, both that they may not contract disease themselves and also that they may produce young ones with no inherited tendencies towards disease, we must feed on foods containing the correct amount of matter for the production of heat, flesh, bone, muscle, feather and fat. For this reason a list is given of a variety of foods in common use, so as to be sure of feeding birds properly in order to allow of their producing a large number of good eggs.

If practicable these mixtures should be varied as much as possible; it would be wise to give Nos. 1, 2, 3, 5, 7, 8, and 9 on successive days, using Nos. 4 and 6 as changes in case of very cold weather; and, although the quantities given will be found sufficient for a pen of ten birds of ordinary size, if Brahmas or Cochins be kept rather more food will be necessary, and the requisite quantity should be added in due proportion to the morning and evening feeds.

The size of the eggs laid depends largely on the matter of breeding and feeding. A plentiful supply of hard grit and good oyster shell (which is of use in supplying lime for the formation of egg shells) should be kept always within reach of the birds, and care should be taken to breed not only from those birds which lay the most eggs but also from those producing fairly large ones. It will then be found, after a year or two, that but few eggs will be obtained which are under the usual marketable size, that is of about 2 oz.

In feeding poultry of any kind it should be remembered that it is as easy to give too much as too little food, especially when birds have their liberty.

One ounce of table salt should be added to the allowance of every 100 birds. If more food be given for the morning feed (see Nos. 7, 8, and 9) less must be given at mid-day.

FOODS FOR PENS OF TEN FOWLS (AVERAGING ABOUT 7 LB. EACH IN WEIGHT) FROM THE COMMENCEMENT OF THEIR LAYING SEASON.

Morning.		Mid-day.		Evening.	
Weight of Food. Ounces.	*Foodstuff.*	Weight of Food. Ounces.	*Grain.*	Weight of Food. Ounces.	*Grain.*
1.— 2 3 *5	Lean meat. Cabbage. Sharps.	12	Oats.	15	Barley.
2.— 2 2 3 *3	Cut green bone. Clover chaff. Barley meal. Bran.	12	Oats.	15	Wheat.
3.— 2 *3 *3 2	Lean meat. Bran. Cut clover hay. Barley meal.	12	Barley.	15	Wheat.
4.— 2 *3 3 2	Cut raw bone. Bran. Chopped cabbage. Sharps (middlings).	12	Oats.	15	Maize.
5.— 2 *3 3 2	Lean meat. Bran. Chopped cabbage. Boiled potatoes.	12	Barley.	15	Wheat.
6.— 2 *3 *3 2	Lean meat. Cut hay chaff. Bran. Pea or bean meal.	12	Oats.	15	Maize.
7.—*3 3 4 2	Bran. Chopped cabbage. Oatmeal. Lean meat.	8	Barley.	15	Maize.
8.—*3 3 2 2 2	Bran. Cut green grass. Buckwheat meal. Barley meal. Cut green bones.	8	Oats.	15	Wheat.
9.—*2 3 4 *3	Bran. Barley meal. Rough oatmeal. Cut hay chaff.	8	Barley.	15	Barley.

Those marked thus (*) should be scalded.

For laying hens during the winter a very good morning food-mixture can be made as follows :—

10.—Scalded bran	... ...	4 parts
Well-cooked maize meal	... ...	2 ,,
Pea meal	... ...	2 ,,
Sharps	... ...	1 part
Cooked lean meat	... ...	1 ,,
Chopped and scalded clover hay	... ...	2 parts

with a light mid-day feed of oats or barley, and an evening feed of either wheat or buckwheat or, if the *weather be very cold*, of broken maize.

The mid-day grain, given at about half-past eleven, should be scattered among litter so that the birds may be forced to take a fair amount of exercise. Quite a small space, comparatively speaking, will do for this purpose, but *it must be light* and, as far as possible, sheltered from cold winds and driving rain. Boards should be placed on edge round the shelter to prevent the birds from scratching out their litter. This litter should be made of hay, straw, long shavings, or dried fern, with some "cavins" (rough chaff from threshing) and dry road scrapings added to allow of the birds taking a dust bath occasionally. The evening feed should be given in a trough about an hour before roosting time.

As a rule those hens which are allowed a grass run can, during the summer, obtain as much green food as they require, but during the late autumn, winter, and early spring greenstuff of some kind must be given them, because there is not very much nourishment in grass during these seasons. The best substitute for summer grass is hay chaff, containing as much clover as possible, for this is "harvested" when in its prime, and it has a large proportion of lime in its composition. Failing clover chaff, cabbage is excellent, as is also spinach. Boiled potatoes are of great use in fattening, but should only be given to grown fowls in very small quantities, and even so only once or twice a week.

The cost of feeding grown fowls, provided there be no waste of food, should rarely exceed 1d. per bird per week, or about 4s. 6d. a year.

Ducks and Geese.

These, it must be remembered, are water-fowl, and should therefore be fed very largely on soft food. If hard corn be given them it should only be fed as a mid-day meal, and should be put in the birds' water troughs, together with a plentiful allowance of grit or gravel.

If water-birds are fed entirely on hard corn they will not do themselves justice as layers.

If ducklings get leg weakness it means that their food is too highly concentrated, and they should be given food largely composed of bran, green food (especially chopped cabbage), and a large amount of grit and cooked meat. Sick birds must always be yarded and fed separately.

If the ducklings show signs of sore eyes the treatment is the same as for leg weakness; if fed very sparingly they will generally be well again in three or four days.

When symptoms of diarrhœa arise isolate the sick birds, feed sparingly on drier food, giving less green food and bran and more meat and grit.

If the little birds are properly fed and cared for no one should lose more than 5 per cent. of them from sickness.

Should they at any time get panic stricken—and if unwell they are very likely to become so—hang a lantern up in their yard; they must be kept quiet, as one night's fright will counteract a whole week's careful feeding.

Ducklings cannot stand direct sunshine, and must have plenty of shade to which they can retire at will. Until they are ten weeks old they are no hardier than chicks, but after this they will stand practically anything in the way of weather, and they revel in heavy rains and snow.

The best green foods for ducklings are onion tops, dandelion, chickweed, green clover, green rye and green oats.

If hatched in March, or early April, and fed properly, young ducks will often begin to lay at five months old, but in this case they should be fed very largely on meat and bran, so as to hold them back as much as possible. This is to some extent a matter of breed and feeding. In the winter four or five ducks may run with a drake, in the summer seven.

A duck may be bred from for four seasons.

Grown geese can usually keep themselves, except in so far as grit—of which they need a large supply—is concerned, but the young ones should be fed on the same lines as ducklings, as they will then be found to grow and put on flesh much more rapidly than is usually the case with goslings.

All water-birds require a great deal of green food, grit and animal food of some sort.

Ducklings.

Do not begin to feed until the little birds are twenty-four hours old, then for four days give the following mixture :—

11.—8 parts of well-scalded bran.
9 ,, rough oatmeal.
1 part very coarse sand.

Four times daily.

From four to twenty-one days give as follows :—

12.—7 parts scalded bran.
7 ,, rough oatmeal.
2 ,, finely-chopped green food (if cabbage it must be boiled).
2 ,, maize meal.
1 part cooked lean meat or meat meal.
1 ,, very coarse sand or fine grit.

Four times daily.

From three to six weeks give :—

13.—6 parts scalded bran.
5 ,, maize meal.
5 ,, rough oatmeal.
2 ,, chopped green food.
1 part fine grit.
1 ,, of cooked lean meat or meat meal.

Four times daily.

When from six to eight weeks old those birds selected to be kept as stock birds should have one part of fine bone meal added to the following mixture. For those set aside for marketing this is not necessary :—

14.—8 parts maize meal.
4 ,, scalded bran.
4 ,, rough oatmeal.
3 ,, cooked meat.
1 part grit.

This should be given three times daily, in addition to green food, which, however, may now be reduced in quantity.

From eight to ten weeks :—

15.—8 parts of maize meal.
4 ,, rough oatmeal.
3 ,, scalded bran.
3 ,, cooked meat.
2 ,, grit.

No green food. Three times daily.

Ducks.

For breeding birds, until they show signs of coming on to lay, and if allowed out to graze, feed as follows :—

16.—10 parts bran (if weather be very hot scald this).
4 ,, oatmeal.
2 ,, maize meal.
2 ,, cooked meat.
2 ,, grit.

Give twice a day, and add as much green food as they will eat, chopped clover being the best possible.

For laying birds :—

17.—4 parts of wheat bran.
4 ,, maize meal.
4 ,, oatmeal.
2 ,, cooked meat.
2 ,, finely-chopped cabbage, green rye, or green clover.
1 part boiled turnips or swedes.
2 parts grit.
1 part oyster shell.

Give morning and evening, and at mid-day put a meal of oats barley, or wheat, mixed with grit, into their water troughs.

Turkeys.

These birds come originally from a hot climate and are, therefore, apt to be very delicate in England when young, but if kept very dry both overhead and under-foot, and out of reach of cold winds, they will usually be found to grow fast and do well.

They may be reared in the same way as chickens, but they must be moved on to fresh land every day, for, like pheasants and other wild birds, tainted land affects them very soon and kills them very easily. Turkeys should never be reared two years in succession on the same ground.

Young turkeys when hatched do not seem to know how to feed themselves. It is wise to rear them with chicks for the first few weeks, until they learn how to look after themselves and to find their own food.

Chicks.

With all birds, young ones especially, the greatest care must be taken to keep all coops, brooders, houses, food and water vessels perfectly clean and sweet, or the birds will become weak and ill. With young birds it is well to put a little camphor in their drinking water, as this prevents them catching cold. Should any birds, young or old, die, the carcases should at once be burned or deeply buried. It is a great mistake to leave dead birds lying about. Both chicks and young turkeys will do best if fed for their first month on dry food; they will grow faster, do better, and be far hardier than if given soft food, however carefully it may be mixed.

If the owner has no means of making ordinary mixed dry chick food, about which more will be said later, he will find that canary and millet seeds, groats, cracked peas, and a little hemp seed will be all that is necessary to begin with.

Do not, even in very cold weather, give much maize to young birds, and be very sparing in the use of rice.

The feeding of dry food will be found very economical, for it saves labour, and birds like it and do particularly well upon it. Though newly-hatched birds require little food at a time they should be fed as often as possible, certainly not less than five times a day, for the first few weeks. A little dry food should be put near them last thing at night (but without waking them) so that when they come out in the morning they may find it for themselves. After this early meal they usually go back into their brooders or under their mothers for further warmth and sleep.

It is not possible to say how much food is required by newly-hatched chicks or turkeys, but chicks generally eat about 3 lb. of dry food each during their first eight weeks.

If the weather be very cold and stormy do not let young birds run about in the wet—a sack supported on sticks will give them sufficient room for exercise, though a thatched hurdle will be still better. Put a little chaff, in which seed has been scattered, on the ground under their shelter that they may scratch about and so keep themselves warm.

Their litter should be turned over with a stick every day or two to freshen it and to allow the chicks to find any food which

they may have trampled under foot. Do not, on any account, throw soft food among the litter—it will become sour and do the birds far more harm than good. Should the litter become damp it must be taken away and dry chaff put in its place, or the young birds will catch cold. It is very easy to allow a chick to catch cold, and very difficult to cure it.

For the first 28 days feed them as stated above, only on dry food. It is quite unnecessary to give them chopped egg, custard or bread crumbs. Nature provides them with the requisite amount of egg food, and bread is much too heating for such young birds. They should not be fed until at least twenty-four hours old.

For the first eight days feed upon:—

18.—3 parts canary seed.
3 ,, millet ,,
2 ,, finely-cracked peas (green peas are best).
1 part hempseed.

or

19.—3 parts canary seed.
3 ,, groats.
2 ,, hempseed.
1 part finely-cracked peas.

They may be fed entirely on canary seed and groats if desired, but if so fed the groats should be given separately. The mixtures given above will be found very satisfactory, as no change is then necessary until the birds are fully eight days old.

From eight to twenty-eight days the birds will grow faster if to these foods be added finely-broken wheat, broken white rice (in very small quantities) and yellow maize. A good proportion would be as follows:—

20.—Rough oatmeal	7 parts
Finely cracked wheat ...	8 ,,
,, ,, maize ...	4 ,,
,, ,, green peas ...	4 ,,
Canary seed ...	2 ,,
Millet ,, ...	2 ,,
Hemp ,, ...	2 ,,
Finely-broken white rice ...	1 part
	30

Once a day the little birds should have a meal of finely-chopped cooked lean meat, as much as they will eat clean, and

even if they can get out on to the grass it will be found wise to give them a little chickweed, fresh grass, dandelion, lettuce, spring onion tops, or green clover chopped up quite small.

A very few days will teach one how much of each of the above foods is needed by the birds. One of the most important rules in the feeding of birds is to give them, at each meal, only as much as they will eat clean and to clear away the rest. Here again it must be remembered that cleanliness plays a great part in successful poultry keeping; on no account must filth be tolerated or great mortality will ensue.

When the birds are a month old they should be taught to eat soft food, as they will then put on flesh more rapidly than when fed entirely on grain; if they seem to dislike the change let them miss one meal, they will then be so hungry as to eat without question almost anything which is put before them.

The order of meals from four to six weeks should be as follows, the hours varying slightly according to season :—

7.0	a.m.	A little groats or canary seed put down overnight.
8.30	,,	A warm meal mixed crumbly (either 21, 22 or 23).
10.30	,,	No. 20 mixture as given above.
11.30	,,	Chopped green food.
1.0	p.m.	Cooked lean meat.
2 30	,,	No. 20 mixture.
4.0	,,	A warm meal mixed crumbly (either 21, 22, or 24.)
5.30	,,	No. 20 mixture.

From eight weeks onward to eighteen weeks (if kept for stock), or until put up for fattening, the birds may be given :—

21.—Scalded biscuit meal ...	1 part	Evening feed groats.
,, bran ...	... 1 ,,	
Pea or bean meal	... 1 ,,	
Barley meal ...	... 1 ,,	
Buckwheat meal	.. 1 ,,	

or

22.—Scalded bran ...	... 2 parts	Evening meal cracked wheat.
Barley meal ...	... 2 ,,	
Scalded sharps ...	... 1 part	

or

23.—Scalded bran ...	... 2 parts	Evening dari, or cracked maize.
Oatmeal	... 1 part	
Scalded sharps ...	... 1 ,,	

In each case they should be fed on this soft food three times daily, and they should still have one meal a day of cooked lean meat, and as much green food as they will eat. If kept for stock they may be fed from eighteen weeks until they begin to

lay on any of the above foods, but need only be given two soft feeds daily instead of three as heretofore.

Whole wheat, oats, barley or maize should not be given to young birds until they are at least twelve weeks old. No mention of cooked rice has as yet been made, for the reason that birds brought up as here advised very rarely show signs of diarrhœa, or scour, as it is sometimes called. If, however, it be very cold, or there be a sudden change of weather, scour will sometimes attack the birds. It can nearly always be stopped by putting camphor in their drinking water, and by giving them one meal of well-boiled rice strained as dry as possible. If the "scour" still continues give them, after an interval of forty-eight hours, a second meal of boiled rice to which add two drops of chlorodyne for every bird which is sick; but be sure that it is very evenly mixed.

There is no better tonic for use during cold raw weather than the following mixture. Any chemist can make it up. It is compounded of half fluid ounce sulphuric acid, half pound green copperas, dissolved in one gallon of hot water. The dose for chicks is one table-spoonful of the mixture to every gallon of drinking water, and double that amount to grown fowls, ducks, geese or turkeys, but it should not be given more frequently than twice a week.

It should be kept in glass or stone jars and labelled "Poison."

Fattening.

When chicks reach the age of fourteen weeks they are, or should be, strong enough to be put up for fattening, but backward ones should be allowed another week or two at liberty before being shut up.

Fattening pens can be easily made out of ordinary packing cases from which the top and one side have been taken, or from ordinary hen coops. They should be put upon legs not less than two feet high, and the bottoms of the coops or boxes should be made of one-and-a-half inch slats (slating lathes do excellently) nailed across so as to allow about two inches between each slat.

The bottom will then appear as in Fig. 1.

The front of the pen will be similar to that of an ordinary

hen coop and should have a hinged door or sliding opening so that birds may be easily put in or taken out.

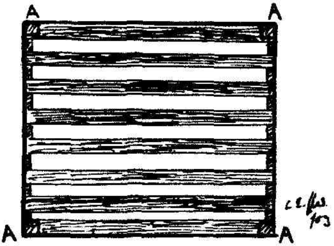


FIG. 1.

Not more than six birds should be put in one coop, and there should be only just room for them to feed comfortably.

The coop will appear as in Fig. 2.

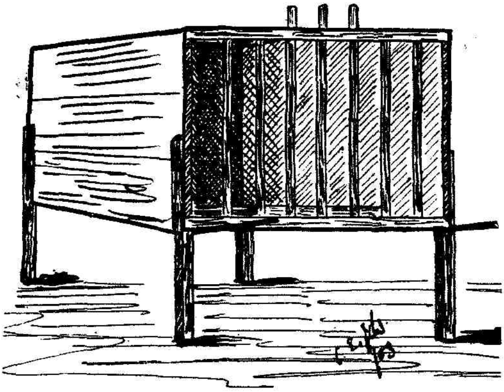


FIG. 2.

The birds should be placed in the coop at night, being first given a good meal and some drinking water. They should

not be fed again for thirty-six hours, as it is well to allow their crops to become quite empty before they be fed in their new quarters.

Unless so starved the birds, especially if taken from a large flock, are apt to pine and to seriously lose condition.

For the first day or two they may be given just a little green food, but this must soon be discontinued.

Unless the coop can be placed in a shed a sack should be hung in front of it at night to prevent the birds catching cold; this should also be done between meals, as exclusion of light induces sleep and the birds consequently lay on flesh more quickly.

The space underneath the coop should be thickly covered with ashes, and all droppings should be raked out and taken away twice a day. Here, again, the utmost cleanliness must be observed, or birds will lose rather than gain in condition and weight.

Two pieces of wood should be nailed to the bottom of the coop to project slightly upwards. On these a wooden trough may be placed at meal times, but it should be taken away directly the birds have finished feeding, and, after any food which may have been left has been taken out, it should be rinsed out with cold water.

Twice a week this trough should be thoroughly scoured out with boiling water and a hard brush.

The foods given to birds while undergoing the process of fattening should be fed in a liquid state, like thick soup, and some grit should be added thereto.

If the birds appear to dislike their food give them a change, *for on no account must they be permitted to go off their feed.* As a rule, however, any one of the mixtures here given may be fed every day.

The best materials to use for the purpose are barley meal, buckwheat meal (which any miller will grind if asked to do so), oatmeal or Sussex ground oats, fine wheat meal, and boiled and mashed potatoes. No hard grain whatever should be given, nor is any drinking water necessary.

Whichever of the following mixtures is given, the foods composing it should be boiled in skim milk, and a little fresh,

rough fat should be melted down and stirred into the mixture while both are hot.

24.—3 parts oatmeal or Sussex ground oats.
1 part maize meal.
1 ,, *fine wheat meal (not flour).*
25.—2 parts Sussex ground oats.
2 ,, barley meal.
1 part mashed potatoes.
26.—2 parts oatmeal or ground oats.
1 part maize meal.
2 parts fine wheat meal (not flour).
27.—2 parts buckwheat meal.
2 ,, maize meal.
1 part barley meal.
28.—2 parts oatmeal.
1 part maize meal.
1 ,, buckwheat meal.
1 ,, mashed potatoes.
29.—1 part (*sifted*) *barley meal.*
3 parts oatmeal.
2 ,, maize meal.

The combination of fat and milk will very greatly improve the quality of the meat.

The quantity required will be from 4 to 5½ oz. of food per bird per day, divided into three equal portions.

Pea meal is not good at this period as it is rather apt to harden the meat.

Birds should not be penned for longer than three weeks, but the exact number of days varies a great deal, as no two birds put on weight at the same rate ; usually from 14 to 17 days will be found sufficient. Some experience is necessary to determine the proper time to kill a bird, and this can only be learned by practice.

No birds should be penned up for fattening unless they are in good condition, as this method of feeding is undoubtedly a great strain on the birds' constitutions.

Ducks, geese, and turkeys can not be shut up in the same manner.

Both ducks and geese should be penned up in small runs off the grass and fed as advised earlier in this article. (Page 360.) If their food be mixed with milk for the last two weeks their flesh will become whiter. For the first day or two they may be given a small quantity of well-boiled cabbage, chopped fine,

once a day, but they must not be allowed water, either to drink or to swim in. A plentiful supply of grit must be given them or they will become ill and so of little or no account.

Turkeys should, for their last six weeks, be housed in large, light, airy buildings, and only allowed out from 11.30 to 1 p.m. each day. For the last ten days they should not leave their houses at all.

Their food can be the same as that given to chickens while penned up.

A useful house for turkeys can be made as follows:—

Take five strong posts each 3 in. by 2 in., three of which are 7½ ft. and two 6½ ft. long. Drive these into the ground so that the three in front stand up 6 ft. from the ground and those at the back 5 ft. (Two of those in front should be only 2 ft. apart, one being for the door to fasten against.) To the tops of these nail strong cross-pieces; on these lay thatched hurdles and fasten them securely.

The sides may be made of wire netting of a wide mesh—3 in. will do—but the north and east sides of shed should be covered with straw or sacking, as the turkeys must be kept fairly warm. The perches should be flat, very strong, and not less than 2 ft. apart.

The door may be of wire netting on a stout frame about 5 ft high by 2 ft. wide, for turkeys will not go into houses having low doors.

Four turkeys may be kept in a house 6 ft. square.

All birds should be starved for thirty-six hours before being killed so that the crop and intestines may become empty. Unless this is done the carcases will not keep for any length of time.

No weight whatever will be lost by this short period of starvation.

C. E. J. WALKEY.

THE SIBERIAN BUTTER INDUSTRY.

The following particulars of the development of the dairy industry have been prepared by Mr. H. Cooke, who recently undertook a commercial mission to Siberia on behalf of the Advisory Committee on Commercial Intelligence of the Board of Trade:—

Prior to 1893 no butter was produced in Siberia for export. The first to engage in butter making by modern methods in Western Siberia was an Englishwoman married to a Russian, whose dairy-farm at Chernaia Reitchka (in 1886 the only one in Siberia), in the district of Tiumen, is still a well-known model of its kind. In 1893 a Russian opened near Kourgan the first dairy producing butter for export abroad. The progress made since has been extraordinarily rapid, so that it is now the main industry of the country, from the point of view of international trade. It is the chief resource of the peasants, who, but for the income thus derived, would depend solely on the fluctuations of the harvest, and during the last three years the harvest has been disastrous.

The following figures point to the advance made of recent years in this new Siberian industry:—

Year.	Number of Dairies.	Export in Cwt.
1898	140	48,360
1899	334	86,730
1900	1,107	354,670
1901	1,800	599,720
1902	2,035	685,500

The Barnoul, or Altai region, has particularly increased its output. Ob station, or Novo-Nikolaievsk, serving this district, despatched but 6 truckloads, containing 738 cwt., in 1899, while in 1902 its export amounted to 995 loads, or 161,000 cwt.

Altogether, from £2,600,000 to £3,200,000 worth of butter is now exported annually from Siberia, or more than twice the value of the wheat export of 1900, the last favourable harvest year.

There is nothing remarkable in the breed of cattle, which are of average size, and, though this may be but temporary, seemed in June at least in poor condition, having suffered from insufficient and inferior food during the winter. The Siberian cow yields little milk, but the quality is notable for richness, and it is just this inherent fatty quality which enables the butter, notwithstanding the conditions under which it is made, to bear the long summer journey to Western markets. About 19 pounds of milk in winter, and 22 in summer, are sufficient to make one pound of butter, while in Denmark some 28 pounds are needed.

The supplies of milk depend, of course, on the stocks of cattle, while the latter, in their turn, depend on the chances and fluctuations of the harvest ; for, if the latter fail, the peasants are constrained to some extent to kill off their surplus stock, or reduce it to a minimum, from want of sufficient fodder in the winter. The progress developed by the butter industry since the construction of the railway has doubled the number of milch cows, in spite of crop failures in the last three years. The butter-making industry has already spread east to the Obi, and is now extending further towards Krassnoyarsk and the Yenesei, while but a few years ago it was confined to the Kourgan and Omsk districts.

The general stock of meat cattle shows no corresponding increase.

The dairies, or " works," as they are termed in Russian, have little in common with the ordinary conception of the word dairy, or of its accompaniments and surroundings, as understood in Western Europe, except that they are places where butter is made. Beyond this, the comparison could not be carried.

They have been hitherto mainly owned and worked by individual peasants, though in some cases the Danish and other export offices have bought up existing works or started new ones of their own.

In general, the dairies, as at present constituted, are still worked under primitive and defective conditions, notwithstanding the efforts of the authorities, special butter officials and instructors, agricultural societies, and of all interested in the extension and development of this new industry. The manufactured product, in consequence, does not reach the high level it might attain.

The effort to effect any speedy appreciable change in the conditions of manufacture, of such paramount importance as they must appear to all, will be a hard and long task, as all struggles against the ignorance and national characteristics of the lower classes must be. Nor, from their point of view, have the latter all the economical encouragement that they should have. What they make, and as much as they can make, they sell, if not to one office, then to the next; if not at the highest price, then at one but slightly inferior. The very small distinction made by the buying offices for quality is insufficient to induce the dairy owner to reconstruct his premises, to reorganise his procedure, or to revolutionise his habits.

He is subjected to no forcible impulse to so order matters as to produce a better article. The excess of competition among the export offices established in Siberia, and the speculative character of the trade itself, soon reveal to the peasant that (beyond a certain point) it is not quality that is of the first importance. Mr. Cooke was told at more than one butter centre, and in the same words, that anything sells "provided only that it is covered by a cask." This may be an exaggeration, but it conveys the general idea.

The main causes influencing the inferior make of the butter are thus stated in an official report of this year :—

"1. The dirty furnishing and set up of the dairies."

"2. The want of technical knowledge on the part of owners and men; and, in general, defective working, packing, and despatch."

"3. General irregular equipment of the dairies."

Another special butter official reports the general sanitary conditions of the Siberian dairies as "beneath all criticism." Yet another official butter instructor, referring to a district comprising nearly 300 dairies, dwells on "the old and confined huts

employed as dairies, in no wise suited to their purpose, with no drainage outlet, and the floor often intersected by large cracks, giving easy access to damp."

"In summer," adds the report, "the presence of a dairy is heralded at a considerable distance by the terrible smell. To diminish the foul odour the owners in some cases have recourse to a mixture of carbolic acid, sprinkling the floor and walls with the same."

Of 283 dairies in the district referred to, 72 consisted of one room, 183 of two rooms, 25 of three, and 3 of four rooms each.

Nor, as regards cleanliness and arrangements, do the public or combined-peasant dairies present any exception in this respect.

"Dirt and disorder find a welcome there." Speaking of 40 such dairies in the district in question in 1902, the report states that, with the exception of seven or eight, the remainder are worked in premises either fitted up somehow for the purpose or in lodgings, two or three are maintained more or less cleanlily, the majority "dirtily in the extreme. The utensils are always badly cleansed, the floor unwashed, the ceilings and walls dirty, milk spilt about, and the atmosphere of the dairy foul. The output is butter of poor quality."

Alluding to the dairies in general, "no attention whatever," it is added, "is paid to the water serving for washing purposes, whether for the utensils or for the butter, foul and stagnant water being at times used."

There must be exceptions, of course, as there are, to this dark side of the Siberian butter industry, but, from the descriptions given on all sides, the official versions quoted as to the insanitary conditions prevailing in the majority of the dairies can by no means verge on exaggeration. Mr. Cooke saw in one instance something of both sides of the question. After a drive of thirty miles to a village in the Kourgan district, he was kindly conducted over the local dairy by the official instructor. The premises were of the primitive wooden hut kind, and the general surroundings certainly not such as are universally associated with the very name of dairy; but, in this instance, the establishment was already condemned, and was at

work for the last time. A new one, on very different principles, was nearing completion close by, under the personal supervision of the instructor, to replace the old one within a fortnight. And here, so far as the premises, the machinery, and the water supply were concerned—and more it was not then possible to judge of—it promised to be a model of its kind.

That the evil is universally recognised is evident from the accounts of the meeting held at Tomsk in March of this year of all interested in the butter industry, at which one of the official butter instructors, among others, "painted a lurid picture of the dirt and disorder which reign, in a greater or less degree, in the majority of the Siberian dairies—a picture of the gross infraction of the elementary requirements of hygiene and of sanitation."* It is unnecessary to quote details. The meeting, after some discussion, carried a formal motion that "the sanitary conditions of the majority of the dairies of Western Siberia are, in a greater or less degree, unsatisfactory," and recommended that the subject be brought to the notice of the authorities with a view to preventive and remedial measures.

It should be added that the official instructors are but few in number compared with the large tracts confided to their care, and that, owing to the dairies being scattered about in distant villages, away from ordinary communications, it is physically impossible for them to exercise any appreciable influence on a general scale. Their duties, too, are rather to advise and instruct, as their name implies, and they are purposely exempt from penal powers, as police duties of the kind would rather impede than further their authority and utility in their intercourse with the dairy owners.

There can be no doubt that improvement must follow in this respect with the gradual spread of enlightenment among the peasantry, assisted by a rigid enforcement of the elementary demands of cleanliness. But a few years ago, in some villages of the Barnoul district, the peasants attributed the bad harvest to the uncanny Danish machines, and "drowned" the separators in the river, but this remnant of superstition seems long past now, so universal is the use of these dairy appliances. With

* *Russki Viedomosti*, Moscow, March 30th, 1903. Also the official *Commercial and Industrial Gazette*, of St. Petersburg, of March 14-27th, 1903.

the establishment of special dairy schools* by the Government, the appointment of more official instructors, and with the efforts of the agricultural societies and authorities in general, the peasants will gradually be compelled to attend to the sanitary conditions of their dairies, and to improve the technical production of the butter.

"Our butter is not bracked" is the answer often given by dairy owners to observations on the state of their dairies or the quality of the butter. The necessity of some system of grading, either in Siberia itself or at the ports of despatch, is insisted upon by impartial authorities, though opposed by the trade as unnecessary and as but occasioning impediments to quick despatch.

The general average of the butter, considering the unfailing demand from year to year, more especially in the British market, must, however, notwithstanding the conditions of its make, have by now reached a certain fair grade, whether it be for table use, or for confectionery and similar purposes. This demand the local buying offices in Siberia must satisfy. The competition between them is extreme. As things are, the peasant bringing his lot of butter just when most needed cannot be turned off or offended simply because it is of inferior quality, or next time he will carry his goods elsewhere. The trivial difference of 8d. or 1s. 4d. per cwt. for quality is no inducement to the producer to overhaul his works or his entire procedure. The trade itself thus brings no practical pressure to bear on the conditions of production. As already mentioned, certain inherent qualities of the butter, due to the richness of the milk, have enabled it to survive even these conditions, as well as the long transport by road and by river, by rail and by sea, to Western markets. Its estimation in the foreign market might, however, be immeasurably raised by improvements in the whole method of production and by the application of the simplest principles of sanitation.

A movement, encouraged by the authorities, is now on foot, and already taking practical shape, to establish peasant co-operative dairies, one for an entire village, or, in some cases, for

* £10,600 has been assigned for one at Omsk. Others will be established at Kourgan and Tomsk. See also the note on page 406 of this *Journal*.

two or three combined hamlets. Loans are granted for the purpose to the extent of not more than £320 for any such co-operative dairy, at 4 per cent. for five years. No risk is run, as the livestock of the peasants alone more than covers the liability. Each peasant joining would thus share in the profits of the dairy according to the amount of milk furnished. Some forty such dairies have already been started, and about two hundred more are expected to be founded this next winter. The pasteurisation of milk is being introduced into these co-operative dairies, cement floors will be made obligatory, and other improvements insisted upon. This movement is expected to gradually work a great improvement in the general sanitary conditions of the dairies, and, consequently, in the quality of the butter turned out. It will work, too, more evenly and advantageously to the general good of the peasants concerned, each of whom, according to the quantity of milk supplied, will directly share in the proceeds resulting from the sale of the butter. It seems more than probable that the whole Siberian butter industry will eventually assume this village co-operative form of production.

Much of the machinery and appliances used in the dairy trade are imported from abroad. The right to import staves duty-free was granted for a period of three years dating from July 3rd, 1900. Local wood, being of too gummy or resinous a character, is not suitable for casks, &c. The dyes used (in summer only) for colouring the butter the yellow tinge required by the British market are chiefly Danish, though Russian are also in use. The latter are said to give an undesirable reddish hue. They are sold in tins of from 5 to 10 and 20 lb. each. The separators are solely Danish or Swedish, a well-known Stockholm make easily holding the field. Agents of the Stockholm and Copenhagen makers of dairy appurtenances work the country thoroughly, while in addition every butter office and dairy is a practical advertisement for their articles. The price lists, catalogues, illustrated sheet advertisements, and coloured pictorial representations of the machines at work, met with in all directions, are all in the Russian language, with moneys, measures, weights, dimensions, &c., in equivalents understood by the people. Competition with them would be out of the

question, unless worked on the same lines with appliances as good and as cheap. Even then they have gained such a hold on the market that newcomers would have an uphill task indeed in attempting to oust them from the footing obtained.

The butter is bought up by the Siberian export offices on cash payments to the peasants, either according to the price ruling for the day, with but little, if any, distinction for quality, or in accordance with contracts at fixed prices, made in advance for a whole season of nine months or a year, for the full output of any particular dairy or dairies. The system of buying on commission from the peasants, with an advance of 90 per cent., is one which the peasant generally abandons after some trials, preferring the certain and immediate settlement and profit to the speculative chances of sale in a distant country, the proceeds of transactions in which he has no means of verifying. Though some of the dairies do export business direct, as a rule the peasant's part in this trade stops with his butter at the local export office. In some cases, instead of cash he takes dairy accessories or agricultural machinery in payment or part payment of his butter. Nearly all the export offices keep stocks of dairy appliances of all sorts in hand, as well as American agricultural machinery.

The busiest export season is from May to August, more especially June and July, though butter is despatched all the year round.

During the summer four special trains of butter-trucks leave the Siberian railway weekly, three for Riga and Windau, and one for St. Petersburg, Novi Port, and Reval. In June five to six trains are despatched weekly. Each train carries from 25 to 28 trucks, coloured white, specially made for this traffic, and refrigerated with natural ice regularly supplied at fixed stations *en route*. The loaded trucks are taken up at the different stations, starting from Ob, or Novi-Nikolaievsk, and completing at Kourgan and Cheliabinsk. The Danish offices load chiefly for Windau, for further despatch to Copenhagen. Others send to Riga for Great Britain. The run from Kourgan to Riga is now accomplished in about eight days. The transport service improves year by year, the authorities having now supplied altogether about a thousand special butter trucks. The iced

depôts at some of the stations, more particularly Novi-Nikolaievsk, are as yet at times insufficient to accommodate the butter supplies awaiting transport. It is detentions of this kind, often in the open, exposed to the sun, that tell on the butter more than the rail journey itself, prolonged as the latter is.

The butter is packed in clean-looking new beechwood casks made locally from imported German or Danish staves. These casks are themselves wrapped round with matting. The empty cask, after being smeared with salt, is lined internally with wet parchment, the butter then being mashed tight in, and coated with salt at the top. The average weight of the filled cask is about 122 lb.

The butter is conveyed by steamships from Windau to London and to Newcastle (*viâ* Copenhagen); from Riga to London, to Hull, and to Leith; and from St. Petersburg (Reval) to London, in each case once a week. The rail freights for butter from Ob station, Omsk, and Kourgan, the three principal Siberian export centres, to Riga and Windau, vary from about 5s. 8d. to 6s. 7d. per cwt. The sea freight from Riga and Windau to London, Hull, or Leith is 1s. 5d. per cwt.

BRITISH CROPS OF 1903.

The preliminary statement of the produce of crops in Great Britain in 1903 was issued by the Board of Agriculture and Fisheries early in December. The estimated average yields of the cereal, root, potato, and hay crops during the current year given therein are summarised in the following table and compared with the average results of the preceding ten years :—

Crop.	Yield per Acre in 1903.	Above or Below Average of 1893-1902.	Crop.	Yield per Acre in 1903.	Above or Below Average of 1893-1902.
	Bushels.	Bushels.		Tons.	Tons.
Wheat ...	30·13	− 0·40	Potatoes	5·16	− 0·73
Barley ...	32·00	− 0·83	Turnips and Swedes	12·43	− 0·45
Oats ...	39·70	+ 1·05	Mangold	17·90	+ 0·11
				Cwts.	Cwts.
Beans ...	31·19	+ 4·12	Hay, from clover, &c.	30·44	+ 2·48
Peas ...	26·56	+ 0·66	Hay, from permanent grass	25·58	+ 3·26
			Hops...	8·78	− 0·18

It will be seen that the relative production of wheat, barley, potatoes, turnips and swedes, and hops was less, and that of oats, beans, peas, mangold and hay greater than the decennial average. It has necessarily to be borne in mind that these figures represent only the estimated quantities grown, and take no account of the condition in which the crops were eventually secured. The reports furnished by the estimators with their returns indicate a very general depreciation in the marketable value of the crops, caused by the excessive rainfall of the year.

The accompanying table shows the total production of wheat in England to have been lower than has been recorded *since the year 1895, although the yield per acre was only about* two-fifths of a bushel less than the average. In the case of Scotland, however, the deficiency on the small area under this cereal was more marked, being over 1½ bushels per acre.

Wheat.	Estimated Total Produce.		Estimated Yield per Acre.		Average of the Ten Years 1893–1902.
	1903.	1902.	1903.	1902.	
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
England ...	45,102,329	53,529,442	30·12	32·82	30·52
Wales ...	1,059,229	1,348,064	24·59	27·96	24·74
Scotland ...	1,481,258	1,799,277	36·01	38·07	37·64
Great Britain	47,642,816	56,676,783	30·13	32·83	30·53

The total quantity of home-grown barley was less than in any previous year, a result largely due to the materially reduced acreage planted with this crop. The yield was about four-fifths of a bushel less than the average, but the loss occasioned by the diminution in quantity is probably insignificant compared with the reduced value of this crop owing to lack of condition and quality.

Barley.	Estimated Total Produce.		Estimated Yield per Acre.		Average of the Ten Years 1893–1902.
	1903.	1902.	1903.	1902.	
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
England ...	49,081,389	54,947,154	31·76	34·80	32·62
Wales ..	2,890,174	3,410,196	29·17	33·66	30·72
Scotland ...	7,502,478	8,137,256	35·05	35·52	35·90
Great Britain	59,474,041	66,494,606	32·00	34·82	32·83

Oats were the most satisfactory of the three principal corn crops, the average production in Great Britain being 1 bushel

more than the average, the excess being, however, exclusively confined to England, where it amounted to 2 bushels per acre. In Wales the results were much less satisfactory, while in Scotland the production fell below the average by nearly half a bushel per acre.

Oats.	Estimated Total Produce.		Estimated Yield per Acre.		Average of the Ten Years 1893–1902.
	1903.	1902.	1903.	1902.	
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
England ...	82,790,458	87,065,205	42·37	46·00	40·36
Wales ...	6,623,032	7,681,445	31·06	36·55	33·24
Scotland ...	35,267,698	35,637,032	36·24	37·34	36·64
Great Britain	124,681,188	130,383,682	39·70	42·65	38·65

The yield of beans in England exceeded the average by about 4½ bushels per acre, while in Scotland, on the other hand, it was about 1½ bushels deficient. With the exception of 1902, the average yield of beans in England has not stood at so high a figure since 1890.

Beans.	Estimated Total Produce.		Estimated Yield per Acre.		Average of the Ten Years 1893–1902.
	1903.	1902.	1903.	1902.	
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
England ...	7,063,775	7,131,349	31·20	31·25	26·76
Wales ...	38,238	31,245	30·06	25·57	23·51
Scotland ...	348,317	438,881	31·24	33·99	32·80
Great Britain	7,450,330	7,601,475	31·19	31·37	27·07

The production of peas represented a yield of about two-thirds of a bushel above the average, though nearly 2 bushels less than that of last year. Practically the whole of this crop is grown in England, the area sown in Wales and Scotland being insignificant.

Peas.	Estimated Total Produce.		Estimated Yield per Acre.		Average of the Ten Years *1893–1902.*
	1903.	1902.	1903.	1902.	
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
England ...	4,763,885	5,039,552	26·60	28·59	25·96
Wales ...	21,320	27,434	20·27	19·94	19·38
Scotland ...	17,918	28,327	26·20	25·94	25·24
Great Britain	4,803,123	5,095,313	26·56	28·51	25·90

The potato crop was about 280,000 tons less than that of 1902, which was itself not a large one. The average yield was generally unsatisfactory, being nearly three-quarters of a ton per acre below the average for the whole country. In England and Wales the decrease was most pronounced, but it was to some extent set off by a return of 5·64 tons in Scotland, which was only about one-tenth of a ton less than the decennial average. In only one previous year—1900—since these returns have been collected has the potato crop shown so poor a result.

Potatoes.	Estimated Total Produce.		Estimated Yield per Acre.		Average of the Ten Years *1893–1902.*
	1903.	1902.	1903.	1902.	
	Tons.	Tons.	Tons.	Tons.	Tons.
England ...	2,041,023	2,225,569	5·07	5·39	5·96
Wales ...	131,846	155,508	4·37	4·95	5·65
Scotland ...	740,844	813,111	5·64	6·27	5·75
Great Britain	2,913,713	3,194,188	5·16	5·57	5·89

Compared with the results obtained last year, the quantity of turnips and swedes available for use this winter is less by some 4,240,000 tons, the very high production of 15 tons per acre which was recorded in 1902 having declined to 12·43 tons in 1903, although this is less by only two-fifths of a ton than the ten years' average. The yield in England precisely coincides

with the decennial average, which now stands at slightly less than 12 tons per acre, but in the case of Scotland an important decline of 1¾ tons per acre is recorded.

Turnips and Swedes.	Estimated Total Produce.		Estimated Yield per Acre.		Average of the Ten Years 1893–1902.
	1903.	1902.	1903.	1902.	
	Tons.	Tons.	Tons.	Tons.	Tons.
England ...	12,996,608	16,023,633	11·97	14·67	11·97
Wales ...	873,684	1,005,208	14·31	16·50	14·81
Scotland ...	6,057,168	7,140,609	13·26	15·67	15·03
Great Britain	19,927,460	24,169,450	12·43	15·02	12·88

Mangold gave better results than turnips, the English average rather exceeding that of the decennium. In Wales and Scotland the quantities obtained were less satisfactory, but the areas sown in those divisions of Great Britain are comparatively small.

Mangold.	Estimated Total Produce.		Estimated Yield per Acre.		Average of the Ten Years 1893–1902.
	1903.	1902.	1903.	1902.	
	Tons.	Tons.	Tons.	Tons.	Tons.
England ...	6,983,763	9,072,616	18·00	21·29	17·84
Wales ...	154,937	198,242	15·10	18·32	16·25
Scotland ...	49,055	76,554	14·84	16·68	17·72
Great Britain	7,187,755	9,347,412	17·90	21·17	17·79

Hay from clover, sainfoin and rotation grasses is reported as yielding 31·69 cwts. per acre in England, or more than 4 cwts. in excess of the decennial yield, but in Wales and Scotland the production fell below the average, so that the excess for Great Britain as a whole was only 2½ cwts. per acre.

Hay from Clover, Sainfoin, &c.	Estimated Total Produce.		Estimated Yield per Acre.		Average of the Ten Years 1893–1902.
	1903.	1902.	1903.	1902.	
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
England ...	*56,941,209*	*57,123,299*	*31·69*	*32·87*	*27·53*
Wales ...	4,567,076	5,920,302	22·45	28·35	23·28
Scotland ...	11,921,099	13,878,813	28·94	33·21	31·83
Great Britain	73,429,384	76,922,414	30·44	32·53	27·96

The position in regard to meadow hay was very similar, the production above the decennial mean amounting to 3¼ tons per acre. Both in Wales and Scotland this crop gave rather better proportionate results than did the hay from clover and rotation grasses.

Hay from Permanent Grass.	*Estimated Total* Produce.		*Estimated Yield* per Acre.		Average of the Ten Years 1893–1902.
	1903.	1902.	1903.	1902.	
	Cwts.	Cwts.	Cwts.	Cwts.	Cwts.
England ...	109,007,844	110,467,298	26·44	27·79	22·62
Wales ...	*8,662,669*	*10,029,186*	*17·78*	*21·16*	*17·88*
Scotland ...	3,961,549	3,967 753	27·46	30·17	28·85
Great Britain	121,632,062	124,464 237	25·58	27·17	22·32

Notwithstanding the over-average production in the hay crop both from arable and pasture land, the total quantity produced did not amount to more than 9,750,000 tons, compared with rather over 10 million tons in 1902.

AGRICULTURAL AND MISCELLANEOUS NOTES.

Parturient Apoplexy.

Parturient apoplexy, also called milk-fever, dropping after calving, &c., is a disease of cows, more especially of milking breeds; and chiefly occurs at the time when they have attained their fullest milking capacity. It has been recognised for generations and has been a fruitful cause of loss to the agricultural community, the deaths in many instances averaging from 40 to 60 per cent. of all cows attacked.

Symptoms.

The disease generally commences within from 12 to 48 hours after an easy parturition, but it may be delayed for a few days longer. (In only extremely rare cases has it come on *preceding* parturition, or *later than* six days afterwards.)

The first noticeable feature is sudden cessation of feeding, rumination, and lacteal secretion, with uneasiness, moaning, dull expression of the eyes, paddling of the hind legs, rapid breathing, swaying from side to side, knuckling over of the fetlocks. Later on the cow drops prostrate. This may be succeeded by a stage of excitement, throwing about of the head and bellowing, but more frequently the cow passes into a semi-conscious, sleepy condition and is unable to rise; she remains in this state, moaning slightly and assuming a characteristic posture, with her neck flexed laterally and her nose touching the point of her shoulder.

As the disease progresses the cow becomes comatose, is unable to see, to swallow, or to void excreta; distension of the belly sets in and death intervenes.

Methods of Prevention and Treatment.

The nature of preventive treatment largely depends on the conditions under which the animals are housed; but the principle involved is always "to bring the animal into a state of health most nearly resembling that of nature."

If the cow is very fat, her condition should be reduced by diminishing the amount and the richness of the food supplied for a week or so before and after parturition; this may be assisted by a judicious use of mild purgatives.

If the surroundings are suitable, the cow, for a fortnight before she is due to calve, might be turned out to graze in a field in which the grass is not too abundant and where she would require to move about in search of her sustenance.

Cows coming near the calving should be kept on a cooling, laxative, and somewhat restricted diet, *e.g.*, roots, weak mashes, treacle. Avoid giving cows, for a couple of weeks before calving, much dry food, and especially chaff and "light" corn.

Some dairymen believe that they secure a high degree of immunity from the attack of the disease by rather frequent milkings of the cow after calving, and by not abstracting more milk at a time than would naturally be taken by a calf.

It may be pointed out that the application of preventive methods is of most importance before the third, and especially the fourth and fifth, calvings; heifers and old cows being less subject to attack.

In the case of cows which might be considered as pre-disposed to the disease, there is reason to believe that the iodine injection mentioned below, used as a preventive immediately after calving, would be attended by good results.

When the symptoms are recognised, a veterinary surgeon should at once be called in. Meanwhile, until he arrives, a simple enema should be given and a good dose of Epsom salts, and the animal might be supplied with a comfortable bed.

The methods of treatment adopted to combat this disease have been many and various and the success which has attended these methods has, to say the least of it, been disappointing. However, within the last few years a Danish veterinarian has been successful in introducing a special treatment, which has

stood a lengthened test and been attended with results that compare favourably with all others, and which appears worth trying generally. The treatment referred to is the injection through the teats into the mammary gland of a solution whose basis is a preparation of iodine, followed by a further introduction of an abundant supply of air, the operation being supplemented by careful and judicious massage of the udder. By this method the percentage of recoveries has been much increased, and if promptly and properly applied a satisfactory result in quite 80 per cent. of the cases treated may be expected.

As the application of this treatment requires special knowledge and skill with delicate manipulation, it is not advisable that any but a veterinary surgeon should undertake it; but under such conditions it should certainly be adopted.*

WILDFIRE IN SHEEP.

The Board of Agriculture and Fisheries have received information of the appearance in some of the western counties of England of a disease known as "wildfire" in sheep. This disease affects the mouths and feet of sheep, and from its general appearance it is sometimes mistaken for foot and mouth disease. Wildfire is, however, quite distinct in its nature from foot and mouth disease. It is confined entirely to sheep, whereas not only sheep but also cattle and swine are affected by foot and mouth disease. Further, in the case of the latter, vesicles or bladders containing a watery fluid form inside the mouth, and usually on the tongue, of affected animals, but they are not present in the disease known as wildfire.

The lesions of wildfire are confined to the skin. It generally commences around the hoof and extends sometimes as high as the knee and hock. It may at the same time be found to exist in the same animals on the skin around the margin of the lips, and over the sides of the face as far up as the eyes. It is apparently of a contagious nature, as it almost always passes through the whole flock.

* Copies of this article may be obtained free of charge and post free on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

This so-called wildfire is, however, benign in its character, and is seldom attended with fatal results, especially if the affected animals are kept away from moisture, and fed upon diets which can be easily taken up by the lips during the time the eruption around the mouth is at its height.

Various remedies are adopted for curing wildfire, but it is found in practice that by carefully tending the animals and feeding them on soft diet the disease passes through its various stages very rapidly, and they recover. On the other hand, dressing with lotions or ointments frequently serves to retard the healing process, especially if the dressings are of a caustic and irritating nature.

THE PINE SAWFLY.

(*Lophyrus pini*, Linn.)

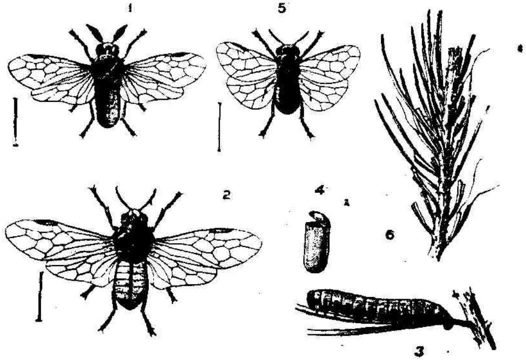


FIG. 1, *Lophyrus pini*, Male; FIG. 2, Female; FIG. 3, Larva; FIG. 4, Cocoon; FIG. 5, *Lophyrus rufus*; FIG. 6, Pine Shoot attacked by Sawfly larvæ.

Pine trees throughout Great Britain of all kinds are frequently seriously damaged by the larvæ of sawflies. The chief culprit is the Pine Sawfly (*Lophyrus pini*), but several other species do considerable harm now and again.

The Pine Sawfly chiefly attacks the Scotch pine, but other species are liable to its invasion. It prefers trees with a sunny aspect, and hence it will be noticed in greatest abundance at the borders of plantations or around clearings. Trees from ten to thirty years old are most subject to the ravages of this pest, but younger and older trees may sometimes be severely attacked. The damage they do is soon noticeable owing to the larvæ feeding in companies. These colonies number sometimes as many as a hundred individuals, but as the larvæ grow they disperse. The damage is chiefly caused by the larvæ eating the needles; this they do in two ways, first by eating notches out of the sides of the needles, and later by eating the whole needles down to their base. There are two broods during the year, the first of which devour the one-year-old needles and the second those of the current year. There are also records of the larvæ eating the young bark.

This forest pest often attacks large areas at the same time. In one instance 2,000 acres were invaded. They often disappear suddenly; this is due to their being so susceptible to climatic changes, cold and wet weather being very prejudicial to them.

Life History.

The parent or adult sawfly is nearly three-fifths of an inch across the wings in the male (Fig 1.), and about four-fifths in the female (Fig. 2). The male is black with the apex of the abdomen reddish, with white spots on the underside of the first segment; in the female the body is dull yellow, with three dark areas on the thorax, and the middle of the abdomen black; the legs are yellow and the wings have dusky borders, which are not, however, so noticeable in the fore wings of the male. The sexes can most easily be distinguished by the male having doubly pectinate antennæ.

The adults appear usually early in May, and again as a second brood in August. The female, which seldom flies owing to her heavy build, lays her eggs in the needles in slits cut by the saw-like processes common to the sawflies. As many as from ten to twenty may be placed in each needle, but as a rule there are not more than six or seven. It is said that one female may lay as many as 120 eggs. The eggs are usually laid in close

proximity, each one being covered over with a gummy and resinous secretion, and so protected from various enemies. This resinous material is scraped from the leaves.

The larvæ hatch in from two to three weeks, appearing at the end of May and in June; by the end of June or in July they reach their full fed stage (Fig. 3), and then pupate. The larvæ are nearly an inch long when full grown, and, like all the larvæ of this genus, they have twenty-two legs. They are at first pale green, almost whitish beneath, and with black sucker feet, but as they mature they become dull brownish-green with dusky marks above the prolegs, and with a dark brown head ; the sucker feet are yellow with a brown line at the base. The first brood feed for from four to six weeks, and then pupate amongst the needles or in cracks and crevices of the bark, the pupa lying in a cocoon of compact brown silk. These cocoons are very variable in colour, some being almost black, others dull brownish-grey. They are about a quarter of an inch long, hard and compact.

In many cases these cocoons remain through the winter, but, as a rule, they give rise to a second brood of flies in August and September ; the progeny of the second brood spin their cocoons mainly amongst the fallen needles, moss and heather beneath the trees. These ground cocoons often occur in bunches, and, like those of the first brood, are very variable in colour. The larvæ which make these cocoons do not enter the pupal stage until the spring. As many as seventy have been found together beneath moss and heather. When the sawfly is ready to emerge it cuts a large circular slit in the top of the cocoon and escapes.

Several other sawflies attack conifers in this country, but the only one recorded as doing damage is the Fox-coloured Sawfly (*Lophyrus rufus*), which did considerable harm in Argyllshire to Scotch pines in 1890. Miss Ormerod found in the Argyllshire outbreak that plants two to six feet high were most subject to attack.

The adult female is reddish-brown, with black spots on the thorax and with yellow to reddish-brown legs ; the male is black with reddish-brown legs. It occurs on the wing in August and September. One brood only appears to exist, and is found in larval form from the end of May until the middle

or end of June. The larvæ are dusky greenish-grey with black heads, a pale line along the back, and a dusky line with a pale one on each side of it above and below; the spiracles are placed in the lower pale line. The sucker feet and underside of the body are pale green. When full grown they are rather more than half an inch in length, and then form an oval, pale yellowish-brown parchment-like cocoon, both amongst the needles and amongst heather, and in the earth, &c., beneath the trees. Like the common Pine Sawfly this also is met with in colonies, two individuals usually sitting on each needle. They pupate in June, those kept under observation going into this stage in the third week in June. Although needles and other "cover" lay on the ground in the breeding cage, they pupated in the earth just as described by Kollar. The females which come from these cocoons lay their eggs in August and September in the needles just as is done by *L. pini.* Apparently the eggs remain in the needles all the winter and hatch out in early May.

Preventive and Remedial Measures.

It does not appear certain that sickly trees are more attacked than healthy ones, but in any case attention should be given to maintaining plantations in robust growth. All the Pine Sawflies have many enemies. Amongst these must specially be mentioned mice and squirrels, which devour large numbers of the larvæ hibernating in the cocoons during the winter; the cuckoo, goat-sucker, and starling also devour numbers of the larvæ and adults. Numerous ichneumon flies also prey upon them.

When young trees are invaded, the larvæ may be easily destroyed by crushing them with a gloved hand. This should be attended to in the early stage of an attack, as at that time the larvæ are present in fairly compact groups, and are readily dealt with. Shaking them from the trees on to cloths spread on the ground is recommended, but is a less satisfactory method of destruction than the other. Another plan is to place fresh pine boughs beneath the trees and then jar the larvæ off. All those that fall to the ground collect on the boughs strewn about, and can then easily be burnt. Trees that have been attacked may have the ground around their trunks examined in winter,

when the dead leaves, moss, &c. containing the cocoons may be raked together and destroyed. Ornamental trees in parks and gardens may be speedily cleared by spraying with hellebore wash or arsenate of lead.

RELATIONSHIP OF WOODS TO DOMESTIC WATER SUPPLIES.

This subject has, for more than twenty years, occupied much of the attention of Forest Experimental Stations, especially in Germany, France, Austria, and Switzerland, and in view of its importance the conclusions arrived at may be usefully summarised.

It has been asserted, and theoretically the contention is doubtless correct, that masses of woodland increase the rainfall. The causes of this result are sought for in the reduction of temperature associated with forests, and in the greater absolute and relative humidity of the air in woods. But although it may be possible to obtain experimental proof by means of elaborate and long-continued observations in a region where extensive afforestation or deforestation is taking place, it may at once be said that such tree-planting as is practically possible in Britain can have no appreciable influence on the rainfall. Trees do, however, under certain conditions of the atmosphere, condense dew on their leaves and branches, and this effect may often be seen in the wet state of the ground underneath trees on a foggy morning when the surface elsewhere is comparatively dry.

But the case is materially different where the fate of the rain and snow that falls on a tract of woodland is considered. The foliage, branches and stems of the trees intercept much of the rain and snow, so that it never reaches the ground at all, the amount so intercepted usually ranging from 30 to 45 per cent. of the total, but much depends on the character of the rainfall and on the species of tree. In a district of heavy annual rainfall a smaller proportion of the precipitation is caught by and evaporated from the trees than where the rainfall is light. Similarly, in the case of heavy and long-continued rain, as contrasted with gentle showers; in the latter case, in fact, but little

of the water reaches the ground through the leafy canopy of a dense forest. Then, again, much depends on the kind of tree, evergreens intercepting more water throughout a year than deciduous trees; and a larger proportion of the rainfall is evaporated from the leaves and branches in summer than in winter.

But although less rain-water reaches the soil of a wood than finds its way to the ground in the open country, the moisture in the soil is much better conserved in the former than in the latter case. This is due partly to the exclusion of the sun's rays by the foliage, partly to the absorbent and retentive character of the decaying vegetable matter that covers the ground of a dense and well-managed wood, and partly to the air in a forest being more humid, and thus better fitted to discourage evaporation. The lace-work of tree roots, too, that occupy the soil of a forest, offers mechanical resistance to the rapid surface-flow and percolation of water. It is also to be noted that roots penetrate to great depths, and when they die they leave holes through which water readily penetrates from the surface. The friable condition of the soil of a wood, too, permits ready percolation of water, whereas in the open country the denser character of the surface of the ground is less favourable to the entrance of water. The consequence is that streams in a wooded country are not so subject to rapid rises and falls, the flow being maintained more equably throughout the year.

Where water-supply for domestic or industrial purposes is concerned the avoidance of violent freshets on the one hand and scanty flow on the other is alike desirable. Not only may the water of sudden and heavy floods be lost owing to the incapacity of the reservoir to contain it, but such floods have also the disadvantage of carrying much mud and similar material in suspension, and this gradually silts up reservoirs, besides entailing increased expenditure in filtering.

It may be pointed out that the water of a reservoir surrounded by well-stocked woodland is not subjected to the same amount of violent agitation during gales as is the case where such sheltering agency is absent. The mud and silt deposited on the bottom, and especially along the margin, is, consequently, left comparatively undisturbed, with corresponding advantages in the matter of purity.

When a catchment area is covered with trees, and with the vegetable matter that accumulates on the surface of the ground, the water that reaches the soil as rain is impeded in its flow, and its evaporation is hindered so that the general effect is equivalent to an increase in the size of the reservoir. It is also important to note that snow melts more slowly underneath trees than in the open country, so that at a time of thaw the snow-water is yielded up more gradually.

Forests not only affect the degree of moisture in soil, but they also exert considerable influence on the soil-temperature. Although this influence is greatest at the surface of the ground, it is also perceptible to a depth of several feet. On the average of a large number of Continental stations it was found that woods of various species and ages depressed the mean annual temperature at the surface of the ground by about 2·6 deg. F., while even at the depth of 4 ft. the reduction of temperature was 2 deg.

This general cooling influence is due to a variety of causes. The foliage of the trees excludes the sun's rays, the decaying vegetable matter that covers the ground prevents the free exchange of air between the soil and the atmosphere, while the water in the soil absorbs much heat without its temperature being much affected.

While woods have a depressing influence on the mean annual temperature, it is found that this effect is much greater in summer than in winter. On the average of eleven German stations the July temperature of the surface soil in the forest was found to be 7 deg. F. lower than that in the open field, whereas in December the former was rather warmer than the latter. Forests, therefore, tend to equalise the temperature of water collected in them, the temperature being slightly raised in winter and markedly reduced in summer. This result would appear to be of considerable practical and hygienic importance where a supply of water for domestic purposes is concerned.

To the credit of forests is also to be placed the fact that they exercise a purifying influence both on the air and on the soil, germs of all kinds being markedly scarcer in a well-wooded district than in a similar extent of treeless country.

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ANALYSIS OF SOUR MILK.

In connection with the circular recently issued by the Board on the analysis of sour milk*, it is considered desirable to give publicity to the following correspondence between the Public Health Department of the Metropolitan Borough of Bermondsey and the Principal Chemist of the Government Laboratory.

I.

From Medical Officer of Health, Bermondsey, to Principal Chemist, Government Laboratory.

"Metropolitan Borough of Bermondsey,
"Public Health Department,
"Town Hall, Lower Road, S.E.
"October 19th, 1903.

"SIR,—The circular letter of August 17th from the Board of Agriculture, regarding the analysis of sour milk in the Government Laboratory, was referred to our Public Analyst for comment and afterwards to me.

"The Public Analyst stated he considered the results 'are, on the whole, satisfactory, but it must be borne in mind that they were, no doubt, obtained under the most favourable conditions,' but 'these conditions are not always present in the case of samples taken under the Act.' As a remedy, he suggests that the bottles which the Inspectors keep should be provided with indelible labels, and pasteurised or sterilised to prevent them going sour.

"In commenting upon his letter I took the position that it might be considered by the defendants into interfering with the milk. In the second place, it would require somewhat greater expense; and, thirdly, I did not think it necessary, since, according to the report of the Government Analysts, the changes are definite which take place in milk, and can be allowed for; and that, with proper collection and storage of the samples, no changes need take place which interfere with the analysis.

"I further reported to the Public Health Committee of this

* *Journal*, Sept., 1903, Vol. x., p. 230.

Council that it would be better for the suggestion to come from the Board of Agriculture if they thought it advisable.

"I have been requested by the Public Health Committee, before they bring the matter before the Council, to ascertain the views of the Government Analysts and the Board of Agriculture as regards collecting samples.

"I am,

"Your obedient Servant,

"(Signed) R. K. BROWN,

"Medical Officer of Health."

"Dr. T. E. Thorpe,

"Government Laboratory, W.C."

II.

From Principal Chemist, Government Laboratory, to Medical Officer of Health, Bermondsey.

"Government Laboratory,

"Clement's Inn Passage,

"Strand, London, W.C.

"21st October, 1903.

"SIR,—I beg to acknowledge the receipt of your letter of the 19th inst. relative to the circular issued by the Board of Agriculture on the subject of the analysis of sour milk.

"I am gratified to learn that the Public Analyst for Bermondsey considers that the results of the enquiry as to the corrections which have to be made in consequence of the changes which the milk may experience on keeping 'are on the whole satisfactory,' but with respect to his qualification, may I assure both you and him that the conditions under which the milk was kept were in no wise different from those in which the samples would be kept by the Inspector. The conditions were precisely those which would be present in the case of samples taken under the Act. Indeed, to have placed the milk under 'the most favourable conditions,' or, indeed, under any conditions which were in any sense exceptional, would have been to defeat the object of the inquiry.

"All experience goes to show that the changes which may occur in samples, as actually taken and retained by Inspectors, do not affect to any material extent the analytical results. Of

course both the physical and chemical changes, which take place in milk on keeping, are apparently very profound; the lactose is more or less converted into lactic acid and the casein is precipitated. Sour and curdled milk is apparently very different from fresh milk. But the real point is that these changes do not materially affect the accuracy with which the total solid matter, or the fats and non-fats, present in the fresh milk, may be ascertained, and hence do not materially affect the certainty with which the charge of watering or abstraction of fat may be substantiated or disproved. Lactose, by hydrolysis, gives its own weight of lactic acid, and the fat itself is practically unaffected by the souring.

"The sole difficulty arises from the circumstance that concurrently with the transformation of the lactose into lactic acid a certain very small quantity of the sugar is converted into alcohol and into more or less acetic acid. The amount so formed is very variable, and may depend upon accidental circumstances such as the absence or presence of particular spores or ferments. The samples upon which our experiments were made were market milks, just as liable to the influence of accidental germs or stray ferments as those taken by an Inspector. The difficulty after all is only a minor one as the extent of the change is very small as a rule. Although its degree cannot be followed with absolute precision, it must be obvious to anyone who will look at the published results, or better still repeat the work for himself, that a very close approximation to accuracy is obtained.

"I am of opinion that processes involving sterilisation, pasteurisation, or the use of antiseptics are not called for, and might introduce far more elements of uncertainty in the case than they are calculated to remove.

"The circumstances do not call for any departure from established usage. If an Inspector intelligently follows the procedure which has been laid down by the Board of Agriculture, there is really no difficulty, in the great majority of cases, in affording the Court the information required. In the very few and wholly exceptional cases in which we are unable to give the information, owing to the condition of the sample, we say so. In the larger number of these exceptional cases the

condition of the sample may be attributed to a want of care on the part of the Inspector. A dirty bottle may have been taken, or it may be only partially filled, or a bad or loosely-fitting cork may have been used, or the sample may have been kept in too warm a place. In such cases, a glance at the sample, before even the bottle is opened, is frequently enough to show that the milk has been improperly divided or improperly preserved, and that we shall probably find it impossible to make a satisfactory examination. But that the Inspectors do as a rule exercise proper care is quite evident from the appearance of the great majority of the samples received by us.

"At the same time, I would strongly impress upon Local Authorities the necessity of seeing that Inspectors are provided with adequate arrangements for securely and properly storing reference samples, as miscarriages of justice have undoubtedly arisen from the absence of such proper arrangements.

"I am, Sir,

"Your obedient Servant,

"(Signed) T. E. THORPE."

"Dr. R. K. Brown, B.A., D.P.H.,
"Public Health Department,
"Town Hall, Lower Road,
"Bermondsey, S.E."

COLD STORAGE OF PEARS.

In the summer of 1901 a series of experiments upon the cold storage of pears and other fruit was begun by the Bureau of Plant Industry, United States Department of Agriculture. *Bulletin No.* 40 issued by the Bureau contains an account of the results of the preliminary investigations in pear storage carried out in 1901 and 1902.

The Bartlett and Kieffer pears were principally used in the experiments. The Bartlett represents the delicate-fleshed, tender pears, ripening in hot weather, which are withdrawn from storage before the weather becomes cool. The Kieffer, on the other hand, is a coarse, hard pear, which ripens later in the

autumn in cooler weather, and in which the normal ripening processes are slower.

The results of the experiments show that pears of all kinds need to be picked before they reach maturity, and to be ripened in a cool temperature, if the best texture and flavour are to be developed. It is a matter of practical judgment to determine the proper picking season, but the stem should at least cleave easily from the tree before the fruit is ready to pick. Many trees bear fruit differing widely in the degree of maturity at the same time, and in such cases uniformity can be obtained only when the orchard is picked several times, the properly mature specimens being selected at each successive picking. This practice not only secures more uniformity in ripeness, but the fruit is more even and the average size is larger than when all the pears are picked at the same time.

The pears should be stored at the earliest possible time after picking. If they cannot be kept in a cool place it is better not to pick them, as they ripen much more rapidly after being picked than they do in a similar temperature while hanging on the tree. The effect of delay in storing is most serious in hot weather and with varieties that ripen quickly.

The fruit should be stored in a temperature of about 32 degrees Fahrenheit, unless it is desired to ripen it slowly in storage, when a temperature of 36 or 40 degrees Fahrenheit, or even more, may be advisable. The fruit keeps longest, and retains its colour and flavour best, at the low temperature ; it also deteriorates less rapidly when removed from storage. The packages used in the store should be such as to allow the heat of the pears to radiate freely. This is especially necessary in hot weather and with quickly ripening varieties like the Bartlett pear, which are liable to ripen in the centre of a barrel before the fruit has cooled down. For late pears that are harvested and stored in cool weather it is not so important. A box holding not more than fifty pounds is a desirable storage package, and it is not necessary to have it ventilated. For larger packages ventilation is necessary, especially if the fruit is warm when stored and ripens quickly The chief value of a ventilated package lies in the rapidity with which the contents are cooled, but it has the disadvantage that

long exposure to the air of the storage room causes the fruit to wilt.

It was found that the pears kept very much better and for a longer time if each fruit was separately wrapped up in some kind of paper, and the advantage of the wrapper was more marked as the season progressed. Early in the season the influence of the wrapper is not so important, but if the fruit is to be stored until late spring the wrapper keeps the fruit firmer and brighter. It prevents the spread of fungus spores from one fruit to another and thereby reduces the amount of decay. It checks the accumulation of mould on the stem and calyx, and in light-coloured fruits it prevents bruising and the discoloration which usually follows.

But little difference was observed in the efficiency of tissue, parchment, unprinted newspaper, and waxed paper as wrappers, except that a large amount of mould was developed on the parchment wrappers at a temperature of 36 degrees Fahrenheit. A double wrapper proved more efficient for long keeping than a single one, and a satisfactory combination was found to consist of an absorbent, unprinted newspaper next to the fruit, with a more impervious paraffin wrapper outside.

The chief advantage of the wrapper for the Bartlett pear, which is usually stored for a short time only, lies in the mechanical protection to the fruit rather than in its efficiency in prolonging its season. Its use for this purpose is advisable if the fruit is of superior grade and designed for a first-class trade. For the late varieties the wrapper presents the same advantages, and has an additional value in increasing the commercial life of the fruit. It is especially efficient, if the package is not tight, in lessening the wilting.

Much of the loss in quality of pears when stored may be attributed to their over-ripeness, owing to the fruit being stored for an undue length of time. The quality is also injured by impure air in the storage rooms. If placed in a room in which there are odours from other products stored there, the pears may absorb them and become tainted. The summer varieties, being generally warm when stored, are especially liable to contamination in this way. The air of the storage room should therefore be kept sweet by proper ventilation.

The rapidity with which the fruit deteriorates after removal from storage depends upon the nature of the variety, the degree of maturity when withdrawn, and the temperature into which it is taken. Summer varieties break down normally more quickly than later kinds. The more mature the fruit when withdrawn the more quickly does spoiling begin, and a high temperature hastens deterioration. If taken from the storage house in a firm condition to a cool temperature, the fruit will keep in good condition as long as other pears at a similar degree of maturity that have not been in storage.

It pays to store the best grades of fruit only. Fruit that is imperfect or bruised, or that has been badly handled in any respect, does not keep well.

CREAMERIES AND THE FACTORY AND WORKSHOP ACT, 1901.

The Board have received from the Home Office a copy of an Order issued in pursuance of Section 42 of the Factory and Workshop Act, 1901, granting to creameries the following special exceptions from the restrictions imposed by the Act:—

1. During the months of May to October, inclusive, women and young persons may be employed during a period of employment which shall on Saturdays, or any day substituted for Saturday, in pursuance of Section 43 of the Act, begin at six o'clock in the morning and end at two o'clock in the afternoon, and, on the other week days, begin at six o'clock in the morning and end at nine o'clock in the evening, and shall, on Sundays and holidays be a period of three consecutive hours, to be fixed between six o'clock in the morning and seven o'clock in the evening, subject to the following conditions:—

(i.) A woman or young person shall not be employed continuously for more than five hours without an interval of at least half an hour for a meal.

(ii.) There shall be allowed for intervals on Saturday, or the day substituted for Saturday, not less than one hour, and on the other week days not less than five

hours, including the whole time from twelve noon to four o'clock in the afternoon.

(iii.) No overtime shall be worked in the creamery in pursuance of any other exception.

2. In creameries where the above exception is not used, women and young persons may be employed during the said months on Sundays and holidays during a period of three consecutive hours, to be fixed between six o'clock in the morning and seven o'clock in the evening, subject to the following conditions :—

(i.) An interval of not less than half an hour shall be allowed within the period of employment on each week day, in addition to those required by the Act.

(ii.) No overtime shall be worked in the creamery in pursuance of any other exception.

The Order dated the 9th June, 1902, granting special exceptions in the case of creameries in Ireland only, is repealed by this Order.

Before this exception is used in any creamery a notice must, in pursuance of Section 60 of the Factory and Workshop Act, 1901, be posted in the creamery showing the beginning and end of the period of employment and the intervals to be allowed, and a copy of such notice must be sent to the Inspector. The notice must be kept affixed so long as the exemption is used.

Section 32 of the Act forbids any change to be made in the periods or intervals specified in the notice until the occupier has served on the Inspector and affixed in the creamery notice of his intention to make the change, nor more often than once a quarter unless for special cause allowed in writing by an Inspector.

ADULTERATION OF DAIRY PRODUCE.

According to the annual report of the Local Government Board for 1902-3 [Cd. 1700] the total number of analyses under the Sale of Food and Drugs Acts in England and Wales in 1902 was 72,321, or 4,480 more than in 1901. Of this total,

29,452 were of milk, as compared with 26,143 in 1901. The number of milk samples reported against was 3,427, or 11·6 per cent., this being the highest rate of milk adulteration recorded for any year since 1893. Legal proceedings were instituted in respect of 1,939 of the adulterated samples, and there were 1,545 convictions, the penalties amounting in the aggregate to £3,783, including 266 fines of £5 and upwards. Cream samples were taken in 150 instances, of which 69 were reported to contain boric acid, while of 176 samples of condensed milk examined 17 were condemned.

The number of samples of butter tested was 13,387, or 1,449 more than in 1901. Adverse reports were made in 865 cases, or 6·5 per cent. of the number examined, as against 10·3 per cent. in 1901 and 7·8 per cent. in 1900. Analyses were also made of 1,048 margarine samples, of which 81, or 7·7 per cent. were found to be adulterated, this figure comparing very unfavourably with that for 1901, when only 1·6 per cent. of the margarine samples analysed were reported against.

The analyses of cheese amounted to 1,797, adulteration being detected in 1·9 per cent. of the samples examined, as compared with 1·1 in 1901.

Among other articles examined may be noticed 552 samples of bread, 565 of flour, 244 of oatmeal, and 2,105 of lard, the numbers reported against being 2, 8, 0, and 33 respectively.

The use of preservatives or colouring matters was reported in 1,190 samples taken under the Acts, including 386 of milk and cream, and 579 of butter and margarine; 940 of the samples contained boracic acid or its preparations, 83 contained salicylic acid, 75 contained formic aldehyde, and 92 contained some other preservative or colouring matter.

CONSTRUCTION OF WHEELS OF LOCOMOTIVES ON HIGHWAYS.

The Local Government Board issued on the 21st November last an Order permitting, under certain conditions, the use of locomotives on highways the driving wheels of which are shod with wooden blocks. The new Order rescinds the Orders of the 26th November, 1897, and the 4th November, 1898, and

modifies the provisions of sub-section (4) of Section 28 of the Highways and Locomotives (Amendment) Act, 1878.

It provides that a locomotive may be used, the driving wheels of which, instead of being smooth-soled or shod with diagonal cross-bars, are shod with wooden blocks, subject to the conditions that the width of each block, measured along the circumference of the wheel, shall be not less than 6 in. ; and measured across the circumference of the wheel, shall also be not less than 6 in. Provided that if the width prescribed by sub-section (1) or sub-section (2) of Section 28 of the Highways and Locomotives (Amendment) Act, 1878, for the tire of the driving wheels exceeds 18 in., the width of any block, measured across the circumference of the wheel, shall be not less than the width prescribed by such of the following rules as may be applicable to the circumstances of the case, viz. :—

If the width of the tire does not exceed 20 in. the width of the block shall be 6½ in. If the width of the tire exceeds 20 in., but does not exceed 22 in., the width of the block shall be 7 in. If the width of the tire exceeds 22 in., but does not exceed 26 in., the width of the block shall be 8 in. If the width of the tire exceeds 26 in., but does not exceed 28 in., the width of the block shall be 8½ in.

The interval between any two blocks, measured along the circumference of the wheel, shall be not more than 2 in.

The blocks shall be arranged in two or more rows, and so that a straight line drawn through the middle of each block shall pass through the middle of the interval between the blocks of the next row.

The blocks shall work on efficient springs or other elastic material so as to yield with the pressure of the weight of the locomotive ; but not so that the surface of the wood block shall be at any time level with or depressed below the tire of the wheel.

No wheel shall be used, any block of which is so worn that any metal rim surrounding the block protrudes beyond the surface of the block.

Copies of the new Order may be obtained directly, or through any bookseller, from Eyre & Spottiswoode, East Harding Street, Fleet Street, E.C., and 32, Abingdon Street, Westminster, S.W.

Simple Butter Test.

A simple method of determining the percentage of water in butter is to heat a known weight of the butter in a small saucer-shaped vessel over a small spirit or gas lamp for a few minutes, with constant stirring, until no more steam is observed to arise from it. After being allowed to cool, the butter is then weighed again, and the loss of weight shown gives the amount of water which was in the butter. This method only requires a pair of scales with weights—a cheap apothecary's set is enough —in addition to the lamp and vessel. It is practised in the Cork and Limerick markets, and is quite accurate enough for practical purposes.

Seeds for Poland.

The Board have received information through the Foreign Office that several agricultural societies in Poland have decided to obtain certain seeds from abroad. As the result of enquiries, H.M. Consul-General at Warsaw reports that the only British seeds for which there would be a market in Poland are rape, turnip, peas, and clover—a certain quantity of which are already supplied by British firms.

International Horticultural Exhibition at Düsseldorf.

The Board have received information through the Foreign Office that an International Fine Art and Horticultural Exhibition will be held at Düsseldorf from the 1st May to the 25th October, 1904. Several periodical horticultural shows will take place during the summer, and the Exhibition will include all branches of the horticultural industry. The Exhibition authorities pay the expenses of ordinary railway and boat freight. Forms containing the necessary particulars may be obtained from the Committee at Düsseldort.

Russian Dairy Industry.

H.M. Acting Commercial Agent at Moscow reports that the Russian Government will make an annual grant, from 1904, of £9,552 in aid of the improvement and expansion of the butter industry in European Russia; £8,180 will be granted in each of of the years 1904 and 1905 towards the same objects in Western Siberia; £739 will be devoted in 1904 to the organisation of butter-making societies in Western Siberia; and £528 to the construction of special testing laboratories in European Russia. A large proportion of the two first-named grants will be expended on the salaries of special butter experts and instructors and in organising special courses of instruction.

Warsaw Hop Fair.

H.M. Consul-General at Warsaw reports that, owing to the shortness of the hop crop generally, prices at the Warsaw hop fair were this year very good, first quality hops fetching twice as much as last year. Prices had been steadily rising since the spring, and most of the hops grown in Poland had already changed hands before the fair, growers preferring to sell in the spring so as to get an advance of cash. The hop crop of Poland, which had been expected to be only a little over 8,000 cwt., turned out much better, and amounted to over 13,000 cwt.

HARVEST AND CROP REPORTS.

CROPS IN THE UNITED STATES.

The United States *Crop Reporter* gives, as a preliminary estimate of the average yield of spring wheat, 14·4 bushels per acre. Applied to the preliminary estimate of the area, as given in the last number of the *Journal*, viz.: 17,257,000 acres, this would indicate a production of some 248,500,000 bushels, or a total production, including winter wheat, of nearly 660,000,000 bushels.

Of other crops, the following preliminary estimates are given:—Maize, 2,313,000,000 bushels, or 25·8 bushels per acre; oats, 787,000,000 bushels, or 28·4 bushels per acre. Barley is expected to yield 26·4 bushels per acre; potatoes, 84·7 bushels; and hay, 1·54 tons per acre.

THE FRENCH HARVEST OF 1903.

The following table, which has been compiled from figures published in the *Journal Officiel* of 21st October and 1st November, shows the preliminary official estimate of the area and production of each of the principal corn crops in France for the past season, with comparative figures for 1902:—

Crop.	Area.		Production.	
	1903.	1902.	1903.	1902.
	Acres.	Acres.	Bushels.	Bushels.
Wheat	16,144,800	16,833,000	353,940,200	351,989,700
Mixed corn	417,800	468,000	8,173,700	8,728,800
Rye	3,311,300	3,466 500	59,073,300	49,904,800
Barley	1,871,100	1,882,900	45,894,700	45,718,600
Oats	9,716,300	9,851,000	305,647,600	286,142,400

CROPS IN PRUSSIA.

The following table shows the acreage and production of the principal crops in Prussia in 1903, the figures for 1902 being added for comparison. The returns for the whole of Germany were not available at the time of going to press:—

Crops.	Area.		Production.		Yield per Acre.	
	1903	1902.	1903.	1902.	1903	1902.
	Acres.	Acres.	Bushels.	Bushels.	Bsh.	Bsh.
Wheat	2,575,079	2,770,732	79,222,890	89,062,758	30·8	32·1
Rye	11,306,222	11,603,687	268,655,294	260,933,066	23·8	22·5
Barley	2,265,247	2,158,471	80,382,393	73,370,984	35·5	34·0
Oats	6,953,917	6,725,259	292,292,219	277,063,823	42·0	41·2
			Tons.	Tons.	Tons.	Tons.
Potatoes ...	5,458,379	5,492,462	28,301,464	29,175,733	5·2	5·3
Clover hay ...	2,974,873	3,035,499	6,191,645	5,840,015	2·1	1·9
Lucerne hay ...	213,223	216,797	476,128	490,303	2·2	2·3
Meadow hay ...	8,005,500	8,075,470	12,935,899	12,492,640	1·6	1·5

CROPS IN RUSSIA.

The Board have received information through the Foreign Office that the Central Statistical Committee of the Russian Ministry of the Interior estimate the yield of winter wheat in the 72 provinces of the Empire at 5,369,595 tons, as compared with 5,902,203 tons in 1902, and a quinquennial average of 4,592,765 tons. Of winter rye, the production is given as 22,315,792 tons, the amount in 1902 having been 22,635,000 tons, and the five years' average 20,854,368 tons. Details of the spring sown crops are not yet available.

The production of straw is estimated at 42,534,203 tons, and that of hay at 50,187,708 tons.

PARLIAMENTARY PUBLICATIONS.

Board of Agriculture and Fisheries.—Grants for Agricultural Education and Research, 1902–1903. [*Cd.* 1701.] *Price* 9*d.*

The Board have continued to the older and larger agricultural institutions the financial support of the previous year. In addition to such assistance the Board—as a result of frequent inspection and careful deliberation—have felt justified in supporting by a grant five institutions of a type somewhat different from those already aided, namely, the Harper-Adams Agricultural College, the Cheshire Agricultural and Horticultural School at Holmes Chapel, the East Sussex Agricultural College at Uckfield, the Harris Institute at Preston, and the Cumberland-Westmorland Farm School. The first of these institutions, though more limited in its aims than a university college, has succeeded in securing the position of an educational centre for the agricultural work of a small group of contiguous counties. The next three, serving, as they at present do, single areas of county council administration, are more purely local in character; while the last, though associated with two counties, restricts itself to performing the more limited, though highly important, functions of a farm school. All possess, or have direct access to, farms, and have for their main object the supply of instruction specially suited to the wants of prospective farmers, an object with which the Board are in heartiest sympathy. As a result of this extension of the Board's financial support their grants have been increased by £950, and now amount to £8,900.

Special grants for experiment and research, amounting to £864, were also made, the aggregate of the grants made by the Board thus being £9,764, as compared with £8,768 in 1901–2.

In the course of the Report it is suggested that in many parts

of the country economy and efficiency would be advance. extended joint action on the part of county councils. Instruction in certain restricted and highly specialised subjects is often avoided by a local authority, not because it fails to recognise the importance of the subject, but owing to the fact that the demand within its own area is necessarily insufficient to warrant it in appointing a special instructor. But this difficulty could be entirely overcome by contiguous counties associating themselves for a specific object, as is, in fact, done in many cases with most satisfactory results.

It has for some time been felt that a stage had been reached when a greater measure of co-ordination of effort might with advantage be introduced into the work of field demonstration and experiment. The subject was enthusiastically taken up by the Agricultural Education Association, with the result that a series of detailed schemes suitable for joint action was prepared, and the Board were glad, at the request of the association, to undertake their publication.

As the result of a conference of county council representatives, fruit growers, and others interested in the industry, a scheme has been prepared for securing to the West of England a cider institute, where instruction and research in the cultivation and manipulation of apples and other fruit, and in the preparation and treatment of cider and similar products, may receive attention to an extent impossible in temporary premises.

Part II. of the Appendix to the Report contains a series of accounts of the results of the principal experiments conducted by institutions aided by the Board. Among the subjects of these experiments were the feeding of sheep and bullocks; sheep breeding; the growth of wheat, barley, and oats; the manuring of hops, potatoes, and grass; the variation in the composition of cow's milk; the cultivation of hops; and the rotation of crops.

Part III. of the Appendix contains a statement showing that the total amount expended on agricultural education by English and Welsh county councils in 1901–1902 was about £88,000, or about £2,000 more than in the previous year.

Small Holdings Act, 1892. [*H.L.* 192.]

The Board have recently issued a Return showing, from the introduction of the Small Holdings Act (1st October, 1892) to the 31st December, 1902, the extent to which local authorities utilised their powers under the Act for the acquisition of land.

During this period of somewhat over ten years, eight county councils in England and one in Scotland have acquired under the Act land amounting in all to 653 acres. Of this area, 32 acres have since been relinquished, while 248 acres have been sold and 373 acres let to small holders. The average cost per acre of the purchase of land by the local authorities for the purpose of small holdings, omitting the transactions in London, varied from about £14 in Ross and Cromarty and £23 in Cambridgeshire to £70 in Devon, the average of the 449 acres purchased being nearly £36. An average amount of approximately £2 per acre has been spent by the county councils in the adaptation of the land for small holdings. In two instances the purchasers of small holdings have availed themselves of the provisions of Part II. of the Act to obtain from the county council an advance to enable them to purchase.

Report of the Progress of the Ordnance Survey to March 31st, 1903. [*Cd.* 1688.] *Price* 4*s.* 8*d.*

The revision of the Cadastral Survey of England and Wales on the $\frac{1}{2500}$ scale, which was begun in 1894, has now been completed for the following counties, viz.: Anglesey, Bedford, Berks, Bucks, Cambridge, Carnarvon, Chester, Cumberland, Denbigh, Derby, Dorset, Durham, Essex, Flint, Glamorgan, Gloucester, Hants, Hertford, Hunts, Kent, Leicester, London, Merioneth, Middlesex, Monmouth, Montgomery, Northampton, Northumberland, Notts, Oxford, Salop, Stafford, Surrey, Sussex, Westmorland, and Wilts. The revision is still in progress for the counties of Brecknock, Devon, Hereford, Lincoln, Radnor, Rutland, Somerset, Suffolk, Warwick, Worcester, and York (West

Riding). Maps on the scale of 6 inches to a mile, reduced, as a rule, from the $\frac{1}{2500}$ scale, are published as the revision proceeds; but in uncultivated districts the revision is made direct on the original 6-inch maps. The preparation of the New Series outline map *on the 1-inch scale, with hills, was completed in* December, *1902*. The publication of the 1-inch maps in colour has been continued over the whole of the South of England and Wales, and over part of the Midlands, and has been commenced in the North of England. During the year the issue of a map on the scale of two miles to an inch was commenced. A general outline map and a county or district outline map, with main roads coloured, on the scale of four miles to an inch, have now been published for the whole of England and Wales; while the publication of a coloured map on the same scale, with hills, has been commenced. The outline drawing and engraving of a map of Great Britain on the scale of ten miles to an inch have been completed. This map comprises twelve sheets, of which eight had been published at the end of March last.

The revision of the Cadastral Survey of Scotland on the $\frac{1}{2500}$ scale was begun in 1894, and has been completed for Aberdeen, Argyll, Ayr, Berwick, Bute, Clackmannan, Dumbarton, Dumfries, Forfar, Kincardine, Lanark, Linlithgow, Orkney, Peebles, Perth, Renfrew, Roxburgh, Selkirk, Shetland, and Stirling, and is in progress for Banff, Inverness, Ross and Cromarty.

The field revision of the second revision of the *1*-inch map was continued during the year, and 3,374 square miles were revised and 655 square miles drawn. The publication of the outline map of Scotland on the ¼-inch scale, comprised in seventeen sheets, has been completed, and maps of counties, or groups of counties, as well as a coloured edition of this map, with hills in brown, are being published.

With regard to the re-survey of Ireland, the Director-General states that 14,962 square miles on the $\frac{1}{2500}$ scale have been surveyed, of which 10,073 square miles have been published. The publication of the revised 6-inch, 1-inch, and ¼-inch maps is being proceeded with, and the drawing of the revised map on the scale of ten miles to an inch was nearly complete at the date of the Report.

Final Report of the Royal Commission on Arsenical Poisoning.
[*Cd.* 1848.] *Price* 5½*d.*

The portions of this Report which are chiefly of interest to agriculturists are those which deal with the ways in which foods are liable to become contaminated by arsenic, and the recommendations as to the measures to be taken to prevent injury from arsenic in food.

The principal ingredients of food, or substances used in food preparation, enumerated as liable to contain arsenic are sulphuric acid, hydrochloric acid, glucose, invert sugar, glycerine, certain colouring matters, boric acid, and malt. In all these cases, however, if due precautions are taken, the arsenic can be successfully eliminated, and the Commission lay down various recommendations as regards the precautions which should be taken by manufacturers with this object. In this connection the Commission enquired into the possibility of the presence of arsenic in grains of cereals and roots grown upon land manured with superphosphate containing arsenic, and also in the flesh of fowls to which small quantities of arsenic had been administered during fattening: in neither case did they obtain any evidence of risk arising in this way.

After discussing the existing means of official control over the purity of food, the Commission make the following recommendations upon this branch of their enquiry: There is need for efficient central administration in order that the system of control provided by the Sale of Food and Drugs Acts may be properly utilised, not only as regards fraud, but in the interests of public health. The Local Government Board should have the advice of a special officer with suitable scientific knowledge, in relation with the Government Laboratory, who would be able to obtain all information regarding the manufacture of foods. Official standards for the purpose of the Sale of Food and Drugs Acts—not standards of purity—should be prescribed by the Local Government Board, or, in the case of matters affecting the general interests of agriculture, by the Board of Agriculture. Account would have to be taken, in fixing these, of medical, physiological, chemical, and administrative questions. The

action of the Government Departments in imposing standards should be based upon the advice of a scientific body of the nature of a Board of Reference. The standards, in the case of particular ingredients, would also define what substances should be considered as inadmissible in food on account of their dangerous character. The Sale of Food and Drugs Acts should be so amended as to enable the responsibility for placing deleterious goods on the market to be brought home to the real offender in a way not at present possible. The powers of Medical Officers under the Public Health Acts should be so extended as to enable them to lay an embargo on the sale of suspected goods pending their official examination.

Until official standards have been set up for arsenic as recommended in the earlier part of the Report, the Commission suggest that penalties should be imposed upon the vendor of any liquid food which contained $\frac{1}{100}$ of a grain of arsenic or more in the gallon, and, in the case of solid food, $\frac{1}{100}$ of a grain of arsenic or more in the pound.

In a separate Report, Dr. Thorpe dissents as regards the recommendations relating to official standards and a Board of Reference, preferring that the propriety of fixing standards should be entrusted to specially constituted committees, represented by manufacturers and experts, in particular cases.

LIVE WEIGHT PRICES OF CATTLE.

The returns received from the twenty-one places in Great Britain scheduled under the Markets and Fairs (Weighing of Cattle) Act, 1891, showed that 271,900 cattle and 1,444,897 sheep were exposed for sale in the third quarter of 1903, as compared with 293,293 cattle and 1,524,749 sheep in the corresponding period of 1902. In the case of pigs there was a considerable increase, the number entering the markets during the three months being 102,163, as against 80,323 last year.

Animals.	3rd Quarter, 1903.	3rd Quarter, 1902.
CATTLE:	No.	No.
Entering markets	271,900	293,293
Weighed	42,437	42,140
Prices returned	34,229	33,171
Prices returned with quality distinguished ...	28,311	27,012
SHEEP:		
Entering markets	1,444,897	1,524,749
Weighed	7,402	10,305
Prices returned with quality distinguished ...	6,192	8,466
SWINE:		
Entering markets	102,163	80,323
Weighed	865	618
Prices returned with quality distinguished ...	863	618

The proportion of cattle returned as weighed during the quarter was distinctly higher than in the corresponding period of last year. At the whole of the markets 15·6 per cent. of the number entering were returned as weighed, as compared with 14·4 per cent., while in the English markets alone the proportion was 9·5 per cent. and in the Scottish markets 39·4 per cent., as against 8·9 and 34·7 per cent. respectively in the third quarter of 1902.

Among the English markets Shrewsbury was remarkable for the large proportion of cattle weighed, no less than 45·9 per cent. of the total number being reported as passing over the weighbridge, a considerable proportion of these being stores.

The following table shows for cattle of each grade the average local price during the quarter at thirteen of the scheduled markets from which prices were reported, but it should be noted that in several instances the number of animals in respect to which prices were obtained was too small to permit of the average value being regarded as an absolutely reliable indication of the prices prevailing at the markets.

PLACES.	PRIME or First Quality.			GOOD or Second Quality.			INFERIOR or Third Quality.		
	Number.	Price per Stone.	Price per Cwt.	Number.	Price per Stone.	Price per Cwt.	Number.	Price per Stone.	Price per Cwt.
		s. d.	s. d.		s. d.	s. d.		s. d.	s. d.
Carlisle ...	1,387	4 4½	35 0	610	3 10½	31 0	379	3 5¾	27 10
Leicester ...	344	4 1¾	33 2	84	4 0	32 0	3	2 4¼	18 10
Leeds ...	489	4 4¼	34 10	268	3 11½	31 8	—	—	—
Liverpool ...	1,601	4 3¾	34 6	927	3 9½	30 4	230	3 2¾	25 10
London ...	673	4 8¼	37 6	525	4 3½	34 4	—	—	—
Newcastle ...	442	4 8	37 4	145	4 3¼	34 2	—	—	—
Shrewsbury	63	4 6¼	36 2	142	4 3	34 0	106	3 8¾	29 10
Aberdeen ...	1,683	4 8¼	37 6	1,682	4 4	34 8	1,291	3 4½	27 0
Dundee ...	630	4 7¾	37 2	1,338	4 3¼	34 2	369	3 0¾	24 6
Edinburgh...	214	4 6¾	36 6	3,114	4 4¾	35 2	—	—	—
Falkirk ...	297	4 7¼	36 10	443	4 4	34 8	285	3 10¾	31 2
Glasgow ...	1,866	4 7½	37 0	658	4 6½	36 4	320	4 4½	35 0
Perth. ...	388	4 7	36 8	503	4 3	34 0	243	3 11¼	31 8

For comparative purposes an average monthly price may be obtained by combining the values reported monthly from these thirteen markets in Great Britain, for first and second quality cattle respectively. These figures are given in the table below for the first ten months of the present year, with corresponding figures for 1902.

Prices in July and August were much below those of the

same months last year, when a considerable increase in values took place in consequence of short supplies from abroad. The tendency during the year has been generally downward, and in October prices touched the lowest point, being 33s. per cwt. for second class cattle and 35s. for prime beasts.

MONTHS.	Prime, or First Quality.				Good, or Second Quality.			
	1903.		1902.		1903.		1902.	
	Per cwt.		Per cwt.		Per cwt.		Per cwt.	
	s.	d.	s.	d.	s.	d.	s.	d.
January...	37	8	36	2	36	2	34	6
February	37	0	36	4	35	0	34	6
March	37	0	36	4	35	4	34	6
April	37	2	37	8	35	2	35	10
May	36	8	39	8	34	6	37	4
June	36	8	42	8	34	10	40	4
July	37	0	41	4	34	10	39	8
August	36	2	38	4	34	6	36	6
September	35	4	37	2	33	2	34	10
October	35	0	36	6	33	0	34	4

The sale of a certain number of fat cattle by live weight at an agreed weight per stone or per cwt. was reported at each of the six markets in Scotland, and also at Liverpool, London, and Wakefield. The number of animals reported as being disposed of in this way was 3,218, and about one-half of these transactions took place at Glasgow.

The number of store cattle returned as weighed, for which prices were furnished, was 4,452, the majority being reported from Shrewsbury. The price at this market for second quality cattle was 33s. 4d. per cwt., as compared with 34s. 6d. per cwt. in the corresponding quarter of last year, while first grade animals realised on the average 36s. 2d. against 37s. 4d. per cwt.

The table giving the usual particulars for the quarter is appended.

CATTLE, SHEEP, AND SWINE *entering and weighed at the Markets and Marts of the undermentioned Places, in the* THIRD QUARTER *of* **1903**, *as returned under the Markets and Fairs (Weighing of Cattle) Act, 1891 (54 and 55 Vict. c. 70).*

PLACES.	Cattle.			Sheep.			Swine.		
	Total Number entering the Markets or Marts.	Number Weighed.	Number Weigh'd for which Prices were given.	Total Number entering the Markets or Marts.	Number Weighed.	Number Wgh'd for which Prices were given.	Total Number entering the Markets or Marts.	Number Weighed.	Number Wgh'd for which Prices were given.
ENGLAND.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
Ashford ...	3,446	1	—	34,888	—	—	5,020	—	—
Birmingham ...	4,225	—	—	27,204	—	—	52,573	—	—
Bristol... ...	20,300	—	—	29,135	—	—	—	—	—
Carlisle ...	12,054	2,376	2,376	106,442	—	—	2,751	—	—
Leicester ...	13,762	566	552	23,423	—	—	1,874	—	—
Leeds	8,631	757	757	32,395	131	131	—	—	—
Lincoln ...	2,146	—	—	16,143	—	—	3,476	96	96
Liverpool ..	12,741	2,758	2,758	173,241	1,927	1,927	41	—	—
London ...	16,005	3,487	1,198	132,060	1,020	—	50	—	—
Newcastle-upon-Tyne ...	22,687	587	587	120,451	—	—	6,413	673	673
Norwich ...	18,290	39	10	50,509	—	—	8,078	—	—
Salford ...	22,753	1,165	—	186,799	—	—	658	—	—
Shrewsbury ...	15,365	7,052	4,380	36,676	—	—	6,710	—	—
Wakefield ...	19,091	1,633	127	49,919	135	—	1,334	12	12
York	24,489	—	—	49,652	—	—	1,345	—	—
SCOTLAND.									
Aberdeen ...	10,598	4,676	4,676	84,213	2,802	2,802	4,027	—	—
Dundee ...	4,303	2,337	2,337	7,632	474	474	768	—	—
Edinburgh ...	15,141	7,804	*3,570	71,950	500	500	2,053	—	—
Falkirk ...	2,342	1,025	1,025	3,647	—	—	29	—	—
Glasgow ...	12,387	3,376	2,844	127,715	65	10	1,209	2	—
Perth... ...	11,144	2,798	*1,114	80,803	348	348	3,754	82	82
TOTAL for ENGLAND ...	215,985	20,421	12,745	1,068,937	3,213	2,058	90,323	781	781
TOTAL for SCOTLAND ...	55,915	22,016	*15,566	375,960	4,189	4,134	11,840	84	82
Total ...	271,900	42,437	*28,311	1,444,897	7,402	6,192	102,163	865	863

* Prices for 4,234 cattle in addition to the above were quoted from Edinburgh and for 1,684 cattle from Perth, but without distinguishing the quality.

PRICES OF MEAT, CORN, AND DAIRY PRODUCE.

AVERAGE PRICES of DEAD MEAT, per 8 lb., at the LONDON CENTRAL MEAT MARKET, during the Third Quarter of 1903, and during the Months of September, October, and November, 1903.

(Compiled from the prices quoted weekly in the "Meat Trades' Journal.")

DESCRIPTION.	3RD QUARTER.	SEPTEMBER.	OCTOBER.	NOVEMBER.
BEEF :—	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Scotch, short sides	4 4 to 4 7	4 3 to 4 6	4 4 to 4 7	4 2 to 4 7
,, long sides	3 11 ,, 4 1	3 11 ,, 4 1	4 0 ,, 4 2	—
English...	3 8 ,, 3 10	3 8 ,, 3 10	3 5 ,, 3 8	3 1 ,, 3 6
Cows and Bulls	2 3 ,, 3 1	2 1 ,, 3 1	2 0 ,, 3 0	2 0 ,, 2 9
American, Birkenhead killed...	3 5 ,, 3 7	3 5 ,, 3 7	3 1 ,, 3 5	2 11 ,, 3 3
,, Deptford killed ...	3 6 ,, 3 8	3 6 ,, 3 9	3 2 ,, 3 6	2 11 ,, 3 5
Canadian Ranchers	2 10 ,, 3 3	2 10 ,, 3 3	2 9 ,, 3 0	2 5 ,, 2 9
American, Refrig. hind-quarters	3 8 ,, 3 10	3 8 ,, 3 10	3 8 ,, 3 10	3 6 ,, 3 9
,, ,, fore-quarters	2 3 ,, 2 5	2 3 ,, 2 5	2 1 ,, 2 4	2 2 ,, 2 4
NewZealand, Frzn. hind-quarters	2 9 ,, 2 10	2 8 ,, 2 9	2 7 ,, —	2 3 ,, 2 5
,, ,, fore-quarters	1 9 ,, —	1 8 ,, 1 9	1 8 ,, —	1 7 ,, —
River Plate, ,, hind-quarters	2 9 ,, —	2 8 ,, —	2 6 ,, —	2 2 ,, —
,, ,, fore-quarters	1 8 ,, —	1 8 ,, —	1 8 ,, —	1 6 ,, —
,, Chilled hind-quarters	2 6 ,, 2 8	2 5 ,, 2 7	2 5 ,, 2 7	2 7 ,, 2 9
,, ,, fore-quarters	1 8 ,, 1 9	1 7 ,, 1 9	1 7 ,, 1 8	1 8 ,, —
MUTTON :—				
Scotch	4 8 ,, 5 2	4 7 ,, 5 0	4 6 ,, 4 10	4 6 ,, 4 11
English	4 1 ,, 4 9	4 1 ,, 4 7	3 10 ,, 4 6	3 8 ,, 4 5
Ewes	3 3 ,, 3 8	2 11 ,, 3 4	2 10 ,, 3 5	2 9 ,, 3 4
Continental	3 5 ,, 3 10	3 7 ,, 4 0	3 5 ,, 3 10	3 5 ,, 3 11
New Zealand, Frozen... ...	2 5 ,, 2 10	2 6 ,, 2 11	2 6 ,, 2 9	2 1 ,, 2 9
Australian, Frozen	—	—	2 1 ,, —	2 1 ,, —
River Plate, Frozen	2 6 ,, —	2 8 ,, —	2 5 ,, 2 6	2 2 ,, —
LAMB :—				
English	4 9 ,, 5 7	4 6 ,, 5 1	4 4 ,, 4 8	—
New Zealand, Frozen... ...	3 3 ,, 3 6	3 1 ,, 3 4	3 1 ,, 3 4	3 0 ,, 3 4
VEAL :—				
Best	4 6 ,, 4 11	4 7 ,, 5 0	4 5 ,, 4 10	4 5 ,, 5 0
Secondary and middling ...	3 8 ,, 4 4	3 9 ,, 4 4	3 7 ,, 4 2	3 8 ,, 4 3
PORK :—				
English, best	3 8 ,, 4 0	3 10 ,, 4 2	3 9 ,, 4 1	3 8 ,, 4 0
,, seconds and thirds...	3 1 ,, 3 5	3 3 ,, 3 7	3 2 ,, 3 5	2 11 ,, 3 3

AVERAGE WHOLESALE PRICES of CATTLE and SHEEP, per 8 lb., sinking the offal, at the METROPOLITAN CATTLE MARKET, *during the under-mentioned Quarters of 1902* and 1903.

PERIOD.	CATTLE.			SHEEP.		
	Inferior.	Second.	First.	Inferior.	Second.	First.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
3rd Quarter, 1902	3 1	4 7	5 1	3 8	5 0	5 9
4th Quarter, ,,	2 9	4 4	5 1	3 6	5 0	5 11
1st Quarter, 1903	3 2	4 5	4 11	3 8	5 5	6 2
2nd Quarter, ,,	2 9	4 0	4 7	3 8	5 1	5 9
3rd Quarter, ,,	2 10	4 1	4 7	3 8	4 11	5 8

AVERAGE WHOLESALE PRICES of BEEF and MUTTON, per 8 lb., by the Carcase, at LIVERPOOL and GLASGOW, during the under-mentioned Quarters of 1902 and 1903.

PERIOD.	LIVERPOOL.*		GLASGOW.†	
	BEEF.	MUTTON.	BEEF.	MUTTON.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
3rd Quarter, 1902	2 8 to 4 8	3 4 to 5 0	4 2 to 5 6	4 0 to 5 8
4th Quarter, ,,	2 8 ,, 4 4	3 4 ,, 5 2	3 8 ,, 5 0	4 4 ,, 5 8
1st Quarter, 1903	2 8 ,, 4 2	4 0 ,, 6 0	3 8 ,, 4 10	5 0 ,, 6 4
2nd Quarter, ,,	2 10 ,, 4 2	4 0 ,, 5 10	4 2 ,, 4 8	5 4 ,, 6 8
3rd Quarter, ,,	3 0 ,, 3 10	3 2 ,, 5 2	3 8 ,, 4 10	4 0 ,, 6 2

* Compiled from information furnished by the Medical Officer of Health, Liverpool. The prices quoted are for Carcases of Animals *slaughtered at the Liverpool Abattoir*, and do not apply to Imported Meat.

† Compiled from information furnished by the Principal of the Veterinary College, Glasgow.

BERLIN MARKET.

AVERAGE PRICES of CATTLE, SHEEP, and SWINE (Dead Weight) in the BERLIN CATTLE MARKET in the under-mentioned Months of 1903.

MONTHS.	OXEN.		SHEEP.		SWINE.	
	Per Cwt.		Per Cwt.		Per Cwt.	
1903.	s.	d.	s.	d.	s.	d.
July	67	4	70	9	50	3
August	68	4	71	0	53	7
September	69	4	71	6	52	7
October	69	3	69	7	50	5

NOTE.—The above prices are compiled from the Wholesale Prices quoted in the *Monatliche Nachweise über den auswärtigen Handel des deutschen Zollgebiets.* The prices for swine are live weight prices with 20 per cent. tare.

PARIS MARKET.

AVERAGE PRICES of CATTLE, SHEEP, and SWINE (Medium Quality, Dead Weight), per cwt., in the PARIS CATTLE MARKET in the under-mentioned Months of 1903.

MONTHS.	OXEN.		CALVES.		SHEEP.		PIGS.	
	Per Cwt.		Per Cwt.		Per Cwt.		Per Cwt.	
1903.	s.	d.	s.	d.	s.	d.	s.	d.
September	56	6	65	2	79	5	59	1
October	53	5	67	2	74	10	52	2
November	54	2	66	10	73	4	49	0

NOTE.—The above prices have been compiled from the weekly returns published in the *Journal d'Agriculture Pratique.*

CHICAGO.

AVERAGE PRICES of CATTLE at CHICAGO per cwt. (Live Weight) in the under-mentioned Months of 1903.

MONTH.	Medium to Good Steers.					Good to Choice Steers.					Choice to Extra Prime Steers.				
	s.	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*	*s.*	*d.*		*s.*	*d.*
September ...	22	7	to	24	5	25	4	to	27	3	27	11	to	29	1
October	22	10	,,	24	9	24	9	,,	26	2	26	2	,,	28	3
November ...	21	3	,,	23	3	23	5	,,	24	6	24	6	,,	26	9

Compiled from the Live Stock Reports issued by Messrs. Clay, Robinson and Co., of the Union Stock Yards, Chicago, Illinois.

AVERAGE VALUES, per cwt., of various Kinds of DEAD MEAT Imported into the United Kingdom from FOREIGN COUNTRIES and BRITISH POSSESSIONS in the under-mentioned Quarters of 1902 and 1903.

(*Computed from the Trade and Navigation Accounts.*)

PERIOD.	BEEF.				MUTTON.		PORK.				BACON.		HAMS.	
	Fresh.		Salted.		Fresh.		Fresh.		Salted.					
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
3rd Quarter, 1902 ...	43	10	33	2	38	5	44	2	28	4	55	8	54	9
4th Quarter, ,, ...	42	11	34	6	39	7	44	9	31	0	56	10	55	8
1st Quarter, 1903 ...	41	9	34	3	39	8	44	8	31	0	52	9	54	0
2nd Quarter, ,, ..	41	6	28	11	39	9	43	8	26	6	53	4	54	9
[illegible]d Quarter, ,, ...	39	5	25	5	38	6	43	10	25	3	53	7	56	7

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels,* computed from the Weekly Averages of Corn Returns from the Returning Markets of ENGLAND AND WALES, pursuant to the Corn Returns Act, 1882, together with the QUANTITIES returned as sold at such Markets, in the under-noted periods of the Years 1903, 1902, and 1901.

QUARTER ENDED	PRICES.			QUANTITIES.		
	1903.	1902.	1901.	1903.	1902.	1901.
Wheat.						
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	25 2	27 3	26 3	694,912	826,066	744,018
Midsummer ...	26 11	29 10	27 1	639,441	444,639	547,737
Michaelmas ...	28 8	30 2	26 11	307,834	222,495	535,109
Christmas ...	—	25 0	26 7	—	754,737	778,686
Barley.						
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	23 5	26 8	25 3	975,720	669,251	844,616
Midsummer ...	22 2	25 6	24 9	98,961	40,875	53,408
Michaelmas ...	21 6	25 1	24 0	28,938	32,318	236,164
Christmas ...	—	25 5	26 8	—	2,040,980	2,235,441
Oats.						
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	16 11	20 3	17 6	372,119	239,048	236,316
Midsummer ...	18 0	22 1	19 3	188,528	88,274	81,172
Michaelmas ...	18 0	21 3	18 7	120,931	101,130	131,023
Christmas ...	—	17 0	18 4	—	402,833	265,703

* Section 8 of the Corn Returns Act, 1882, provides that where returns of purchases of British Corn are made to the local inspector of Corn Returns in any other measure than the imperial bushel or by weight or by a weighed measure, that officer shall convert such returns into the imperial bushel, and in the case of weight or weighed measure the conversion is to be made at the rate of 60 imperial pounds for every bushel of wheat, 50 imperial pounds for every bushel of barley, and 39 imperial pounds for every bushel of oats.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each of the under-mentioned Weeks in 1903, and in the corresponding Weeks in 1902 and 1901.

Weeks ended (*in* 1903).	**Wheat.**						**Barley.**						**Oats.**					
	1903.		1902.		1901.		1903.		1902.		1901.		1903.		1902.		1901.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
Jan. 3 ...	25	0	27	7	26	5	23	11	26	7	25	4	16	10	19	10	17	2
,, 10 ...	24	11	27	8	26	7	24	1	26	7	25	6	17	0	20	0	17	3
,, 17 ...	24	11	27	8	26	11	24	1	26	11	25	9	16	10	20	0	17	3
,, 24 ...	25	0	27	7	26	10	24	1	26	7	25	6	16	11	20	3	17	6
,, 31 ...	25	4	27	4	26	7	24	3	26	7	25	7	17	0	20	2	17	8
Feb. 7 ...	25	6	27	2	26	8	23	9	26	9	25	7	16	11	20	3	17	7
,, 14 ...	25	6	26	11	26	4	23	7	27	5	25	4	17	1	20	3	17	7
,, 21 ...	25	4	27	1	26	1	23	4	26	11	25	0	17	1	20	4	17	7
,, 28 ...	25	3	27	1	25	11	23	2	26	8	25	0	17	1	20	5	17	9
Mar. 7 ...	25	3	27	0	25	9	23	1	26	8	25	4	17	1	20	5	17	7
,, 14 ...	25	1	27	1	25	9	22	10	26	6	25	1	17	0	20	6	17	7
,, 21 ...	25	1	27	1	25	8	22	9	26	4	24	11	16	10	20	6	17	9
,, 28 ...	25	2	27	2	26	0	22	4	27	2	24	9	17	0	20	7	18	0
Apl. 4 ...	25	3	27	3	26	3	22	6	26	5	25	3	17	0	20	6	18	0
,, 11 ...	25	4	27	5	26	5	21	10	26	7	26	0	17	2	21	0	18	1
,, 18 ...	25	6	27	7	26	8	21	6	27	1	25	7	17	3	21	1	18	8
,, 25 ...	26	1	28	9	26	8	21	9	26	5	25	8	17	9	21	6	18	8
May 2 ...	26	10	29	9	26	9	22	1	27	5	26	4	18	0	21	10	19	1
,, 9 ...	27	6	30	9	27	3	21	10	26	10	26	2	18	2	22	6	19	1
,, 16 ...	27	9	31	1	27	7	22	5	25	3	24	2	18	4	22	5	19	4
,, 23 ...	27	10	31	6	27	7	23	7	25	4	24	1	18	5	22	6	19	8
,, 30 ...	27	8	31	6	27	7	23	7	25	1	23	8	18	5	22	10	19	9
June 6 ...	27	6	31	3	27	6	23	10	24	3	22	9	18	4	22	11	20	1
,, 13 ...	27	8	30	11	27	8	21	5	23	8	24	0	18	7	22	8	19	7
,, 20 ...	27	6	30	6	27	6	20	7	23	5	23	2	18	3	23	0	20	3
,, 27 ...	27	6	30	5	27	6	22	0	24	3	25	4	18	6	22	9	20	0
July 4 ...	27	9	30	8	27	8	20	7	25	5	21	9	18	6	22	5	19	10
,, 11 ...	28	1	30	10	27	2	19	11	24	8	23	10	18	3	22	10	19	9
,, 18 ...	28	3	30	11	27	3	20	5	23	8	23	4	18	7	22	10	19	11
,, 25 ...	28	7	31	5	27	3	20	10	25	0	22	1	18	5	22	8	19	4
Aug. 1 ...	28	11	31	8	27	6	21	0	25	0	23	1	18	6	22	10	20	0
,, 8 ...	29	3	31	7	27	7	20	1	24	11	22	1	18	8	22	11	19	4
,, 15 ...	29	11	31	7	27	4	21	3	24	9	27	2	18	10	22	2	18	9
,, 22 ...	29	9	31	5	27	3	20	4	22	10	23	7	18	6	21	11	18	1
,, 29 ...	30	0	31	7	27	0	22	3	26	2	24	3	18	7	21	0	17	10
Sept. 5 ...	30	3	29	9	26	5	22	5	24	6	25	1	18	5	19	10	17	6
,, 12 ...	28	6	27	10	26	2	22	4	27	5	24	11	17	0	19	2	17	4
,, 19 ...	27	5	27	1	26	0	24	2	26	4	25	5	16	4	18	4	17	4
,, 26 ...	27	0	26	6	25	10	24	0	26	4	25	10	16	2	18	0	17	2
Oct. 3 ...	26	3	25	10	25	8	23	9	25	11	26	3	15	9	17	5	17	7
,, 10 ...	25	10	25	5	25	9	23	8	26	2	26	5	15	6	17	2	17	6
,, 17 ...	25	8	25	1	25	10	23	9	26	1	26	8	15	5	17	0	17	8
,, 24 ...	25	10	24	11	25	11	23	7	26	4	26	10	15	8	17	0	17	5
,, 31 ...	26	0	25	0	26	2	24	2	26	7	26	10	15	8	17	3	17	7
Nov. 7 ...	26	4	25	1	26	6	24	3	26	3	27	0	15	9	17	2	17	8
,, 14 ...	26	6	25	0	26	9	24	6	25	11	26	9	15	9	17	3	18	3
,, 21 ...	26	9	24	11	27	1	24	3	25	6	26	10	15	10	17	2	18	7
,, 28 ...	26	6	25	0	27	1	23	11	24	11	26	9	15	11	17	0	18	9
Dec. 5 ...	26	8	25	1	27	1	23	9	24	4	26	7	15	9	17	0	19	0
,, 12 ...	26	7	25	0	27	2	23	2	24	3	26	8	15	9	16	10	19	3
,, 19 ...			24	10	27	7			24	2	26	8			16	10	19	8
,, 26 ...			24	10	27	7			24	1	26	8			16	8	19	10

AVERAGE PRICES of WHEAT, BARLEY, and OATS, per IMPERIAL QUARTER in BELGIUM in the under-mentioned Months of 1903.

Month.	Wheat.		Barley.		Oats.	
1903.	s.	d.	s.	d.	s.	d.
August	28	10	22	11	19	8
September	28	2	21	5	15	9
October	27	11	22	1	15	9

The above prices have been compiled from the official monthly averages published in the *Moniteur Belge.*

AVERAGE PRICES of WHEAT, BARLEY, and OATS, per IMPERIAL QUARTER in FRANCE, and ENGLAND and WALES, in the under-mentioned Months of 1903.

MONTH.	FRANCE.		ENGLAND.	
WHEAT.				
1903.	Per Qr. s.	d.	Per Qr. s.	d.
September	36	2	28	3
October	36	1	25	11
November	36	1	26	6
BARLEY.				
1903.	Per Qr. s.	d.	Per Qr. s.	d.
September	22	7	23	2
October	22	6	23	9
November	22	5	24	2
OATS.				
1903.	Per Qr. s.	d.	Per Qr. s.	d.
September	17	4	16	11
October	17	0	15	7
November	16	10	15	9

NOTE.—The prices of French grain have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique.* The prices of British grain are official averages based on the weekly returns furnished under the Corn Returns Act, 1882.

AVERAGE PRICES of WHEAT, BARLEY, and OATS per IMPERIAL QUARTER at LONDON, PARIS, and BERLIN, *in the under-mentioned Months of 1903.*

Month.	London.		Paris.		Berlin.	
WHEAT.						
	Per Qr.		Per Qr.		Per Qr.	
1903	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
July	27	8	42	9	36	11
August	29	6	40	0	35	9
September	28	11	36	4	34	8
October	27	1	36	4	34	3
November	26	10	35	5	—	
BARLEY.						
	Per Qr.		Per Qr.		Per Qr.	
1903	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
July	21	4	24	5	22	10*
August	21	4	23	10	22	10*
September	23	1	23	2	23	0*
October	22	5	22	8	23	2*
November	24	6	22	5	—	
OATS.						
	Per Qr.		Per Qr.		Per Qr.	
1903	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
July	19	3	18	11	18	3
August	19	0	18	4	19	10
September	17	5	17	6	18	10
October	15	11	17	2	18	6
November	16	4	17	4	—	

NOTE.—The London quotations represent the price of British corn as returned under the Corn Returns Act, 1882; the prices of grain in Paris have been compiled from the official weekly averages published in the *Journal d'Agriculture Pratique;* the quotations for Berlin are the average prices published monthly in the *Monatliche Nachweise über den auswärtigen Handel des deutschen Zollgebiets.*

* Prices at Breslau; no quotations for Berlin.

PRICES OF WOOL.

AVERAGE PRICES of ENGLISH WOOL, per pack of 240 lb., in the under-mentioned Months of 1903.

(Compiled from the "Economist.")

DESCRIPTION.	September.	October.	November.
	£ s. d. £ s. d.	£ s. d. £ s. d.	£ s. d. £ s. d.
South Down ...	8 10 0 to 11 10 0	8 10 0 to 11 10 0	8 10 0 to 11 10 0
Half-breds ...	7 12 6 „ 8 6 3	8 5 0 „ 8 15 0	8 5 0 „ 8 15 0
Leicester ...	6 15 0 „ 7 5 0	7 5 0 „ 7 15 0	7 5 0 „ 7 15 0
Kent Fleeces ...	7 5 0 „ 7 15 0	8 0 0 „ 8 15 0	8 0 0 „ 8 15 0

AVERAGE WHOLESALE PRICES of BUTTER, MARGARINE, and CHEESE in the under-mentioned Months of 1903.

(*Compiled from the "Grocer."*)

DESCRIPTION.	SEPTEMBER.	OCTOBER.	NOVEMBER.
BUTTER:	Per Cwt.* s. d. s. d.	Per Cwt.* s. d. s. d.	Per Cwt.* s. d. s. d.
Cork, 1sts	88 0 to —	94 6 to —	93 6 to —
,, 2nds	85 3 ,, —	85 6 ,, —	87 6 ,, —
,, 3rds	81 9 ,, —	82 3 ,, —	81 6 ,, —
,, 4ths	74 6 ,, —	70 6 ,, —	73 0 ,, —
Irish Creameries ...	97 6 ,, 103 0	106 0 ,, 110 6	106 0 ,, 110 0
,, Factories ...	86 0 ,, 95 0	88 0 ,, 98 6	86 0 ,, 98 0
Dutch, Creameries ...	101 0 ,, 104 6	108 0 ,, 112 0	109 6 ,, 113 0
,, Rolls, boxes ...	11 7 ,, 12 7	12 4 ,, 12 8	12 6 ,, 13 4
French, extra mild ...	93 0 ,, 95 0	97 3 ,, 101 3	98 0 ,, 102 0
,, best ordinary ...	86 6 ,, 89 0	91 3 ,, 93 3	92 0 ,, 94 0
,, 2nds and inferior ...	74 0 ,, 83 0	76 9 ,, 87 3	73 0 ,, 87 0
,, Fresh, Paris baskets	93 6 ,, 97 6	100 6 ,, 105 0	101 0 ,, 105 0
,, Rolls, per doz. ...	9 0 ,, 12 1	9 5 ,, 13 1	9 6 ,, 13 6
Italian Rolls, per doz.	10 0 ,, 12 1	10 6 ,, 12 5	11 0 ,, 12 6
Danish and Swedish ...	107 9 ,, 110 6	117 6 ,, 120 9	114 6 ,, 117 9
Russian and Siberian ...	73 6 ,, 92 0	77 6 ,, 94 9	76 6 ,, 95 0
Argentine	90 0 ,, 94 0	95 6 ,, 103 6	94 0 ,, 105 0
Colonial, fine	94 6 ,, 99 6	97 6 ,, 106 0	102 0 ,, 107 0
,, good and inferior	89 0 ,, 93 0	87 6 ,, 95 3	85 0 ,, 98 0
Canadian Creameries ...	88 6 ,, 100 6	91 6 ,, 104 6	92 0 ,, 102 0
,, Dairies	78 0 ,, 87 0	80 0 ,, 89 6	80 0 ,, 90 0
MARGARINE	30 0 ,, 46 0	30 0 ,, 46 0	30 0 ,, 46 0
CHEESE, ENGLISH:			
Cheddar, new	57 0 ,, 70 0	56 9 ,, 73 3	57 6 ,, 74 0
,, loaf	66 0 ,, 68 0	66 0 ,, 68 0	66 0 ,, 68 0
Wiltshire ,, ...	72 0 ,, —	73 3 ,, 74 6	74 0 ,, 76 0
Double Gloucester ...	66 0 ,, 69 0	67 3 ,, 70 0	68 0 ,, 70 0
Derby Factory... ...	56 6 ,, 60 0	56 0 ,, 60 0	56 0 ,, 60 0

* Except where otherwise stated.

WEEKLY PRICES (WHOLESALE) of VEGETABLES and FRUIT at COVENT GARDEN MARKET in each week of November, 1903.

(Compiled from the "Gardeners' Chronicle.")

Description.	Week ending November 5th.	November 12th.	November 19th.	November 26th.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
VEGETABLES—				
Artichokes, Globe, doz.	2 0 to —	2 0 to —	2 0 to 2 6	2 6 to 3 6
,, Jerusalem, sieve	1 6 ,, 2 0	1 6 ,, 2 0	1 6 ,, 2 0	1 0 ,, 1 6
Asparagus, sprue, bdle.	0 10 —	1 0 —	1 0 ,, 1 1	0 10 —
Beans, Dwarf, per lb.	0 4 ,, 0 6	0 6 —	0 8 ,, 0 10	0 8 ,, 0 10
,, Madeira, basket	2 0 —	2 0 —	1 6 ,, 2 0	1 0 ,, 1 6
Beetroots, bushel -	1 6 ,, 2 0	1 6 ,, 2 0	1 6 ,, 2 0	1 6 ,, 2 0
Brussels Sprouts, sieve	1 0 ,, 1 6	1 0 ,, 1 6	1 3 ,, 1 9	1 3 ,, 1 9
Cabbage, per tally -	2 0 ,, 4 0	2 0 ,, 4 0	2 0 ,, 3 6	2 0 ,, 3 6
Carrots, dozen bunches	1 3 ,, 2 0	1 3 ,, 2 0	1 3 ,, 2 0	1 3 ,, 2 0
,, bag - -	2 6 ,, 4 0	2 6 ,, 3 6	2 6 ,, 3 6	2 0 ,, 3 6
Cauliflowers, per doz.	0 9 ,, 1 6	0 9 ,, 1 6	1 0 ,, 2 0	1 0 ,, 1 6
Celery, per doz. bndls.	8 0 ,, 15 0	8 0 ,, 12 0	8 0 ,, 12 0	8 0 ,, 12 0
Cress, per doz. punnets	1 0 —	0 9 ,, 1 0	0 9 ,, 1 0	0 9 ,, 1 0
Cucumbers, per doz. -	2 6 ,, 4 6	2 6 ,, 4 6	2 6 ,, 4 6	5 0 ,, 8 0
Endive, per dozen -	1 0 —	1 0 —	1 0 —	1 0 —
Garlic, per lb. - -	0 2 ,, 0 3	0 2 ,, 0 3	0 2 ,, 0 3	0 2 ,, 0 3
Leeks, per doz. bnchs.	1 0 ,, 1 6	1 0 ,, 1 6	1 0 ,, 1 6	1 0 ,, 1 6
Lettuces, cabbage, doz.	0 4 ,, 0 6	1 0 —	1 0 —	1 0 —
Mushrooms, House, lb.	0 9 ,, 0 10	0 10 ,, 1 0	0 10 —	0 10 ,, 1 0
Onions, per bag -	3 0 ,, 4 6	3 0 ,, 4 6	4 0 ,, 5 0	4 0 ,, 4 6
,, picklers, sieve	3 0 ,, 4 0	2 6 ,, 4 0	2 6 ,, 4 0	2 6 ,, 5 0
,, per case -	5 0 ,, 5 6	5 0 ,, 5 6	5 0 ,, 5 6	5 0 ,, 5 6
,, English, cwt.	— —	5 0 ,, 5 6	5 0 ,, 5 6	4 6 ,, 5 0
Parsley, doz. bunches -	1 0 ,, 1 6	1 0 ,, 1 6	1 0 ,, 1 6	1 0 ,, 1 6
,, per sieve -	0 9 ,, 1 0	0 6 ,, 1 0	0 6 ,, 1 0	0 6 ,, 1 0
Parsnips, per bag -	2 6 ,, 3 0	2 0 ,, 2 6	2 0 ,, 2 6	2 0 ,, 2 6
Potatoes, per ton -	80 0 ,, 130 0	80 0 ,, 130 0	75 0 ,, 130 0	80 0 ,, 130 0
Radishes, doz. bunches	0 9 ,, 1 0	0 9 —	0 9 —	0 8 —
Salad, small, doz. pnts.	1 0 —	0 9 ,, 1 0	0 9 ,, 1 0	0 9 ,, 1 0
Shallots, per lb. -	0 1½ ,, 0 2	0 1½ ,, 0 2	0 1½ ,, 0 2	0 1½ ,, 0 2
Spinach, per bushel -	1 6 ,, 2 0	1 6 ,, 2 0	3 0 —	3 0 —
Tomatoes, English, per doz. lb. - -	4 6 ,, 5 6	3 6 ,, 4 6	3 0 ,, 5 6	3 0 ,, 4 0
Tomatoes, Channel Islands, per lb. -	0 3 —	0 3 —	0 3 —	0 2½ ,, 0 3
Turnips, doz. bunches	1 0 ,, 1 6	1 0 ,, 1 6	1 0 ,, 1 6	1 0 ,, 1 6
,, bags - -	2 0 ,, 2 6	2 0 ,, 2 6	2 0 ,, 2 6	2 0 ,, 2 6
Watercress, doz. bnchs.	0 4 ,, 0 6	0 4 ,, 0 6	0 4 ,, 0 6	0 4 ,, 0 6
FRUIT—				
Apples, home-grown, cookers, bushel	3 0 ,, 8 0	3 0 ,, 8 0	3 0 ,, 10 0	3 0 ,, 8 0
,, per half bushel	2 0 ,, 4 0	2 0 ,, 4 0	2 0 ,, 5 0	2 0 ,, 6 0
,, per barrel -	14 0 ,, 23 0	12 0 ,, 23 0	12 0 ,, 18 0	10 0 ,, 20 0
,, dessert, ½ bush.	3 0 ,, 5 0	3 0 ,, 5 0	— —	— —
Blackberries, per peck	2 6 ,, 3 0	2 6 —	2 6 —	— —
Chestnuts, per bag -	6 0 ,, 14 0	5 0 ,, 12 0	6 9 ,, 14 0	6 6 ,, 18 0
Cobnuts, per lb. -	0 7½ ,, 0 8	0 7½ ,, 0 8	0 7½ ,, 0 8	0 7½ —
Cranberries, per case	12 0 ,, 13 0	15 0 —	15 0 —	13 0 ,, 15 0
Grapes, Canon Hall A per lb.	3 0 ,, 4 0	3 0 ,, 5 0	3 0 ,, 5 0	3 0 ,, 4 0
,, ,, B ,,	1 3 ,, 2 0	1 6 ,, 2 6	1 6 ,, 2 6	1 6 ,, 2 6
,, Alicante, lb. -	0 6 ,, 1 0	0 7 ,, 1 3	0 7 ,, 1 3	0 8 ,, 1 0
,, Gros Maroc, lb.	1 0 —	1 0 —	1 0 —	— —
,, Muscats, A, lb.	3 0 ,, 4 0	3 0 ,, 4 0	3 0 ,, 4 0	2 6 ,, 3 6
,, ,, B, ,,	0 8 ,, 1 3	0 9 ,, 1 6	0 9 ,, 1 6	1 3 ,, 1 9
Melons, each - -	1 0 ,, 2 0	2 0 ,, 3 0	1 0 ,, 3 0	1 0 ,, 3 0
Pears, per case - -	5 6 ,, 16 0	5 0 ,, 14 0	8 0 ,, 15 0	5 0 ,, 17 6
,, stewing - -	5 0 ,, 6 0	6 0 —	6 0 —	6 0 —

DISEASES OF ANIMALS ACTS, 1894 to 1903.

NUMBER of OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	QUARTER ENDED.		NINE MONTHS ENDED.	
	Sept., 1903.	Sept., 1902.	Sept., 1903.	Sept., 1902.
Foot-and-Mouth Disease :—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	120
Swine-Fever :—				
Outbreaks	306	455	1,185	1,323
Swine Slaughtered as diseased or exposed to infection ...	1,949	2,161	6,140	6,259
Rabies :—				
Number of Cases :—				
Dogs	—	—	—	12
Other Animals	—	9	—	11
Anthrax :—				
Outbreaks	156	143	585	520
Animals attacked	218	205	887	830
Glanders (including Farcy) :—				
Outbreaks	467	321	1,150	884
Animals attacked	802	544	1,937	1,576
Sheep-Scab :—				
Outbreaks	53	35	1,118	1,078
Animals attacked	1,033	1,026	13,677	13,471

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction in Ireland.)

DISEASE.	QUARTER ENDED.		NINE MONTHS ENDED.	
	Sept., 1903.	Sept., 1902.	Sept., 1903.	Sept., 1902.
Swine-Fever :—				
Outbreaks	81	58	145	147
Swine Slaughtered as diseased or exposed to infection ...	1,572	1,109	3,136	2,920
Rabies :—				
Number of Cases :—				
Dogs	2	—	2	—
Anthrax :—				
Outbreaks	—	—	2	—
Animals attacked	—	—	3	—
Glanders (including Farcy) :—				
Outbreaks	1	2	2	8
Animals attacked	1	14	3	35
Sheep-Scab :—				
Outbreaks	16	16	407	447

ORDNANCE SURVEY MAPS OF GREAT BRITAIN AND IRELAND.

The chief Maps published by the Ordnance Survey are on the following scales :—

Scale		Price per Sheet, Uncoloured.
$\frac{1}{500}$ or about 10 feet to one mile ... $\frac{1}{1056}$ or five feet to one mile ...	For towns only	**2s. 6d.**
$\frac{1}{2500}$ or 25·344 inches to a mile complete for Great Britain. (*In progress in Ireland*)		**3s. 0d.** With Areas. **2s. 6d.** Without Areas.
$\frac{1}{10560}$ or six inches to a mile complete for Great Britain and Ireland		**2s. 6d.** Per Full Sheet **1s. 0d.** Per Quarter Sheet.
$\frac{1}{63360}$ or one inch to the mile :— 1. Outline with contours ... ... 2. With Hills in black ... ... 3. With Hills in brown. (*In progress*) ... ... 4. In colours, with Hills and contours.* (*In progress*)		**1s. 0d.** Per Sheet for England Wales and Ireland. **1s. 9d.** Per Sheet for Scotland. (Double Size)
$\frac{1}{126720}$ or 2 miles to one inch selected areas for England and Wales.* (*In progress*) ...		**1s. 0d.**
$\frac{1}{253440}$ or 4 miles to one inch—General Map. Ireland. (*In progress*)		**1s. 6d.** Per Sheet for England and Wales. **1s. 0d.** Per Sheet for Scotland and Ireland.
County Maps for Great Britain*		**1s. 0d.**
$\frac{1}{633600}$ or 10 miles to one inch—General Map ...		**1s. 0d.**

These Maps are periodically revised, except the Town Maps, which are only revised at the expense of the Town. The Series marked thus * are issued folded for the pocket.

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ADVANTAGES TO DEPOSITORS.

SECURITY.—The Post Office Savings Banks are established by Act of Parliament, and every depositor has the *direct security* of the State for the repayment of his deposits.

DEPOSITS.—Any sum from a shilling upwards, excluding pence, may be deposited at one time, and any number of deposits may be made in the course of a year (ending 31st December) up to a limit of £50. A person may have £200, in all on his deposit account, including interest.

WITHDRAWALS can be made with the utmost promptitude by sending notice by post to the London Chief Office on the form provided for the purpose, which is obtainable at any Post Office Savings Bank, and payment can be received at any Post Office Savings Bank in the United Kingdom convenient to the depositor without regard to the office of deposit. During any year ending 31st December a depositor may replace the amount of any one withdrawal previously made in the same year.

INTEREST at the rate of £2 10s. per cent. per annum is allowed on every complete pound deposited, so long as the sum to a depositor's credit does not exceed £200. Whenever the balance exeeeds that sum, interest will be allowed on £200, and the excess will be invested for the depositor in Government Stock, unless the depositor should otherwise direct.

TRANSFER FROM A TRUSTEE SAVINGS BANK.—If a depositor in a Trustee Savings Bank wishes to place his money in a Post Office Savings Bank, he should apply to the trustees of the Savings Bank for a Certificate of Transfer (in the form prescribed by the 10th section of the Act 24 Vict., c. 14), and should pay the certificate into any Post Office Bank as if it were a cheque. By adopting this course the depositor will avoid trouble and the risk of carrying cash from one bank to the other.

DEPOSITOR'S BOOK CAN BE USED AT ANY POST OFFICE SAVINGS BANK. A depositor may add to his deposits, or withdraw the whole or any part of them, at any Post Office Savings Bank in the United Kingdom, without change of deposit book.

NOMINATIONS.—A depositor at the age of sixteen years, or upwards, may, subject to certain limits, nominate any person to receive his Savings Bank deposits at death. A form for the purpose may be obtained, free of cost, from the Controller of the Savings Bank Department.

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POSTAGE FREE.—No charge for postage is made to a depositor, if in the United Kingdom, for any letter passing between him and the Chief Office on Post Office Savings Bank business.

LIST OF LEAFLETS ISSUED BY THE BOARD OF AGRICULTURE.

(*a.*) *Leaflets dealing with Insects and Fungi injurious to Crops.*

No.	Title.	No.	Title.
1	Black Currant Mite.	46	Stem Eelworm.
2	Vine, Plum, Hop and Raspberry Weevils.	47	Asparagus Beetle.
		48	Pea and Bean Thrips.
3	Turnip Fly or Flea.	49	Fruit Tree Beetle.
4	Caterpillars on Fruit Trees.	52	Gooseberry Mildew.
5	Mangold Fly.	53	Pear Midge.
10	Wireworms.	56	Canker Fungus.
11	Daddy Longlegs or Crane Fly.	60	Wood Leopard Moth.
12	Gooseberry Saw Fly.	62	Pear and Cherry Saw Fly
14	Raspberry Moth.	64	White Root Rot.
15	Apple Blossom Weevil	65	Small Ermine Moths.
16	Apple Sucker.	68	Currant Aphides.
19	Pea and Bean Weevils.	69	Tent Caterpillars.
20	The Magpie Moth.	70	Winter Washing of Fruit Trees.
22	Diamond-back Moth.	75	Root-knot Eelworm in Cucumbers and Tomatoes.
23	Potato Disease.		
24	Ribbon Footed Corn Fly.	76	Cucumber and Melon Leaf Blotch.
25	Chafer-beetles or White-Grubs.	77	Finger-and-Toe in Turnips.
30	Codling Moth.	86	Brown Rot of Fruit.
31	Onion Fly.	87	Fungus Disease of Young Fruit Trees.
33	Surface Caterpillars.	88	Hop Aphis.
34	Woolly Aphis or Apple Root Louse.	90	Pith Moth.
35	Celery Fly.	91	Pine Beetle.
38	Carrot Fly.	92	Bunt and Smut.
41	Red Spider.	94	Millipedes and Centipedes.

(*b.*) *Leaflets dealing with Wild Birds.*

No.	Title.	No.	Title.
40	Kestrel or Wind-hover.	50	Water Wagtails or "Dishwashers."
42	Short-Eared Owl.	51	White or Barn Owl.
43	Titmice.	54	Spotted Flycatcher.
44	Common Lapwing, Plover, or Peewit.	55	Swallow.
		84	House Sparrow.
45	Starling.		

(*c.*) *Leaflets dealing with Animals, including Poultry.*

No.	Title.	No.	Title.
13	Acorn Poisoning.	78	Liver Disease of Poultry.
21	Warble Fly.	81	A Substitute for Dishorning.
28	Anthrax.	82	Preparation of Wool for Market.
29	Swine Fever.	83	Preservation of Eggs.
57	External Parasites of Poultry.	89	Fluke, or Liver Rot in Sheep.
58	Internal Parasites of Poultry.	95	Ringworm in Calves.
61	Sheep Scab.	96	Parturient Apoplexy.
67	Favus in Poultry.		

(*d.*) *Leaflets relating to Acts of Parliament.*

No.	Title.	No.	Title.
8	Farmers and Assessments to Local Rates.	27	Remission of Tithe Rentcharge.
		39	Assessment to Land Tax.
26	Farmers and the Income Tax.	66	Workmen's Compensation Act, 1900.

(*e.*) *Leaflets dealing with Miscellaneous Subjects.*

No.	Title.	No.	Title.
6	Voles and their Enemies.	73	Cultivation of Maize for Fodder.
9	Ensilage.	74	Purchase of Feeding Stuffs.
32	Foul Brood or Bee Pest.	79	Rations for Farm Stock.
36	Cultivation of Osiers.	80	Use of Artificial Manures.
63	Destruction of Charlock.	85	Haymaking.
72	Purchase of Artificial Manures.	93	Farmyard Manure.

The issue of Leaflets 7, 17, 18, 37, 59 and 71 is suspended.

Copies of these Leaflets may be obtained free of charge and post free on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W. Letters of application so addressed need not be stamped.

THE JOURNAL

OF THE

BOARD OF AGRICULTURE.

VOL. X. No. 4. MARCH, 1904.

AGRICULTURAL CORRESPONDENTS.

The President of the Board of Agriculture and Fisheries has nearly completed the appointment of Honorary "Agricultural Correspon dents" in every county of Great Britain.

These Agricultural Correspondents will be glad from time to time to receive from farmers detailed information as to any matters in regard to which the Board might be of service to them, as, for example:—

Losses arising from the use of unsuitable, defective or worthless seeds.

Difficulties in connection with the selection and use of fertilisers and feeding stuffs, and complaints as to their quality or failure.

New descriptions of fertilisers and feeding stuffs.

Losses arising from parasitic or other diseases of animals except foot and mouth disease, pleuro-pneumonia, swine-fever, sheep scab, glanders, anthrax, or rabies. (Notice of these must be given to the police).

Losses arising from the attacks of insects and diseases affecting crops.

The spread and suppression of weeds.

The partial or complete failure of crops from exceptional causes.

New methods of cultivation and the growth of new crops.

The practical value of new implements and machinery.

Difficulties in the growth and treatment of orchard and garden produce.

The deterioration and possible improvement of pasture.

New and special methods of dairying and new descriptions of produce.

Difficulties in the breeding and feeding of live stock.

Inadequacy of railway and other facilities for transit.

Complaints as to railway rates.

Difficulties at markets with regard to tolls and accommodation (including weighbridges).

Loss of markets at home or abroad, and the decline of prices from any exceptional circumstances.

Methods of marketing and requirements of purchasers as to quality, packages, &c.

Any information or assistance which can be given to farmers in connection with any of these matters will be supplied as speedily as possible either by the Agricultural Correspondent himself or from the Offices of the Board.

The Board would also be obliged if farmers and others would communicate to the Agricultural Correspondents information as to matter likely to be of service to agriculturists generally.

The Board have made arrangements with the Postmaster-General for the exhibition, at all rural post-offices in Great Britain, of notices giving the name and address of the Agricultural Correspondents appointed in each district.

OIL ENGINES FOR AGRICULTURAL PURPOSES.

In some industries a considerable money value may be placed on that which is comprehensively called "convenience." Generally, this pertains to things which save trouble, economise effort, or in any way save time, and in some manufacturing or business establishments and offices where there is much repetition work, "convenience" may have a direct and measurable value.

In agricultural matters this is not so often the case, and a new method of performing any given operation must in most cases commend itself on the ground that it performs that operation more cheaply than the old, through cheapness or lessened quantity of materials employed, or lessened total cost of the operation, including labour.

In some things, however, even in agricultural operations, reduction of time occupied is as important as in any other industry. This is most obvious with the reaping and other machines, which, doing most work in least time, make the most of the clement hours, the duration of which the farmer cannot control.

Other operations may be more cheaply conducted if they can be carried out at convenient times, *i.e.*, at times when the labour required is not occupied on other work or cannot be seasonably employed upon it.

In many of these cases the saving of time may be synonymous with saving of labour, and, although not at all times in the year, the saving of labour may be the same thing as saving money, and the saving of time the saving of a market.

In these cases the command of a ready source of power for farm and dairy purposes is one of the most fruitful sources of economy. The adoption of mechanical means of performing work becomes more than ever important now that all the world

outside the United Kingdom has learned to appreciate machine tools, and, what is more, to make them.

Power to work these machines, then, becomes a necessity, and as power is now one of the cheapest things that can be wanted in any industry, those who neglect to use mechanical power for every useful purpose are neglecting opportunities.

For many years now the farmer has had the steam engine at his command, and many have used its power in limited applications; but the steam engine itself is limited in its offer of convenience. Even the useful small engine employed for the many minor operations requiring only two to four horse-power, of which many thousands are in use all over the kingdom, does not offer sufficient convenience in its use to encourage its employment and, therefore, that of power-driven machines.

Fortunately, it has happened that with the rise and progress of the use of farm and dairy machinery, the oil engine has arisen too, and is now a well-developed and trustworthy source of power. With it the steam engine has to be compared—mainly on the ground of convenience.

When preparations for the working of a motor occupy sufficient time and trouble to make them a matter for consideration, they are only made when there is enough work to be done to justify them. Work which it would be convenient to do to-day or this morning were the starting of the motor a nominal operation, must be postponed until this evening or to-morrow, when the quantity of work to be done by the machines is enough to justify the trouble and expense of getting up steam. This consideration does not present itself when there is a good deal of work or continuous work, as in a manufactory, where engines and machines are running all day; but it does on a farm. In brief, it does not pay, either from a cost or from a convenience point of view, to light a fire and get up steam.

Viewed from these standpoints the oil engine has a great advantage over the steam engine. It moreover has no boiler needs no fire, no fire-making, and no stoking; needs very little more attention than the steam engine without the boiler, needs very little water instead of a lot, and when the work is done and the engine stopped, five minutes' attention will leave the engine in order for the next period of working.

A further convenience arises from the difference between the work of handling the petroleum and handling coal or coke. The small steam engine, with the ordinary small vertical boiler used with most of them, will require from 5 to 8 tons of coal for every ton of oil used by the oil engine. This requires handling on receipt and handling by shovelsfull into a fire grate by hand.

The oil is not only so many times less in weight, but in most cases the engine supplies itself from the casks, or the casks in properly arranged engine houses are so placed that the oil runs without any attention to the supply reservoir.

The oil engine or most oil engines require occasional cleaning out, but this does not take so long as the occasional cleaning out of a boiler, and even if it did the saving in labour in other ways is so great that the cleaning out work time is over and over again saved. Some engines require more frequent attention to the cleaning of the vapouriser and passages, in which carbon may be deposited, than others, but regular attention avoids difficulties.

Oil engines, like gas engines, are the modern development of the hot-air engine. The oil is simply used as a means of rapidly heating the air, compressed in the engine cylinder, to a high temperature almost instantaneously. It is convenient from a mechanical point of view, and for heat economy reasons, to burn the oil thus rapidly in the working cylinder, directly with the air to be heated and used as the working medium, rather than to burn the oil as a fuel for indirectly heating the air. The engines are thus known as internal combustion engines, as distinguished from steam engines, for which the steam as the working medium is generated by combustion of oil or other fuel in a boiler and not in the engine cylinder.

The oil is prepared for its ready combustion in the oil engine cylinder by several different forms of vapourisers. In some, the vapouriser consists simply of a chamber at the end of the cylinder, into which the oil is injected in the form of a fine spray under considerable pressure.

The vapouriser chamber is at first heated by an exterior heating lamp so as to convert the spray into a vapour, which will ignite when the engine, by turning the fly-wheel, compresses and heats a charge of air and vapour. Explosive combustion of the hydrocarbon vapour taken up by the air then occurs, and

the heat so generated maintains the vapouriser thereafter at a sufficiently high temperature without the aid of the external heating lamp. This is in outline the method of the Hornsby-Ackroyd engine.

In other engines the oil simply drops into a passage sometimes heated by a lamp or by the heat due to explosive combustion, through which it is drawn by the inrushing air supply through the inlet valve. This system is adopted by several makers, including Ruston, Proctor & Co., and Crossley Bros., and by some the drops of oil are measured at each working stroke, as in the Roots engine, in which the frequency of the drops is determined by the hit-and-miss action of the governor.

A few illustrations will serve to show the construction and general principles of action of some of the engines which have become favourably known.

Fig. 1 is a diagram of the cylinder and valves of a Hornsby-Ackroyd engine, but with the valves placed horizontally instead of vertically for the purposes of explanation.

In this diagram will be seen the piston, which may be assumed to be moving in the cylinder in the direction of the arrow under the pressure due to the combustion of working charge of oil vapourised in the vapouriser and mixed with the required quantity of air. The valves during this working stroke of the piston would be closed as shown. When this stroke has been completed the exhaust valve E will be lifted, and the engine crank connected by the rod R to the piston will push the piston back towards the vapouriser, and the products of the combustion of the last charge will escape by the exhaust pipe. The piston being then at the end of its instroke, the air admission valve A is lifted, and the crank and connecting rod R pull the piston outward again, and a charge of air is drawn into the cylinder by it. A small quantity of oil is at the same time sent into the vapouriser by an oil pump, the oil breaking up into a fine spray as it enters. It is immediately vapourised, and the cylinder is now full of air, mixed to a small extent with oil vapour, and the vapouriser is full of oil vapour, mixed with a small proportion of the products of combustion of the last working stroke. The momentum of the fly-wheel, by means of the crank and connecting rod, now forces the piston back towards the vapouriser,

and this compresses to a pressure of about 40 lb. per square inch the whole air and vapour contents of the cylinder and vapouriser into the vapouriser and the small passage connecting it and the valve chamber to the cylinder. This compression of the charge raises its temperature, and the vapouriser being very hot, the charge ignites and burns explosively. That is to say, the vapour burns at great velocity, using the oxygen of the air and causing the instantaneous expansion of the cylinder contents. As, however, the outward movement of the piston is arrested by its connection with the engine crank, which it can only move slowly in comparison with the rate at which the air would expand if free to do so, the air rises in pressure to, say,

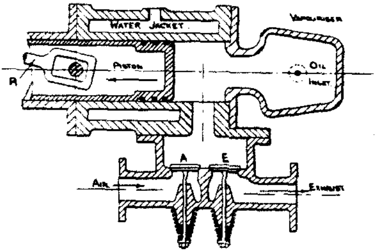


FIG. 1.—DIAGRAM OF HORNSBY-ACKROYD ENGINE.

200 lb. per square inch, more or less, according to the load on the engine and the action of the governor. This pressure acting on the piston forces it outward again, giving motion to the crank and fly-wheel, which stores up the work done on this stroke. From this short description of the operations it will be seen that only one out of four strokes of the piston is a working stroke, so that each working stroke has to give two revolutions to the fly-wheel, which must, therefore, be heavy in order that it may store sufficient energy to keep the engine running at its proper speed until the working stroke recurs.

It will, of course, be understood that the vapouriser must be heated by extraneous means to enable the engine to be started. After it has once been started the heat due to compression of the charge and its combustion keeps the vapouriser at the

temperature necessary for the ignition of the charge. Means are provided for maintaining the proper temperature with a full or with light load, although the heat due to combustion may vary through a considerable range. Ingenious devices are also used by means of which the total capacity of the spaces into which the air and vapour have to be compressed may be changed to suit the different kinds of oil that may be used.

The initial heating of the vapouriser is effected by means of an oil lamp of the Bunsen burner type, requiring no fan for its operation. It takes from 8 to 12 minutes to heat the

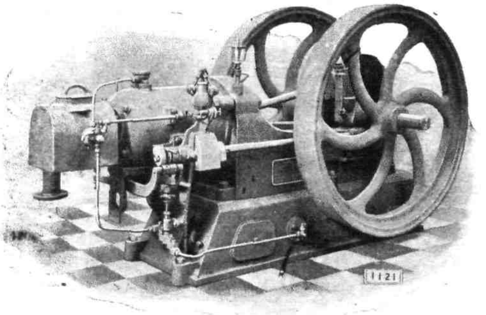


FIG. 2.—HORNSBY-ACKROYD OIL ENGINE (30 H.P).

vapouriser sufficiently to start the engine with the ordinary petroleum oils, such as Royal Daylight, Tea Rose, Water White, or the heavier oils, such as Russolene. In a slightly modified engine the cheaper Texas oil may be used. The cost of the oil as fuel for these and other oil engines may be taken as a secondary consideration, whether with reference to the small engines chiefly used for agricultural and estate work or for larger sizes. These engines are all of the horizontal cylinder type, one of which, as made for using the cheaper crude or semi-crude petroleums, is shown by Fig. 2, which is from a photograph of a 30 brake horse-power engine. From it will be seen the position of the oil pump taking oil frcm the

tank in the engine base and forcing it through the spraying jet into the vapouriser; the rocking levers for working the valves and actuated by the cams on the half-speed shaft, which also works the governor; and the vapouriser enclosed in a partly removable cover. This cover and a water jacket round part of the vapouriser afford further means of suiting the temperature of the vapouriser to the oil in use and the work being done.

The same type of engine is adapted as a portable engine for farm use by mounting it and a jacket water-cooling tank on a four-wheel underframe with shafts. The advantages which accrue from the use of the portable oil engine are partly derived from the low cost of oil fuel, namely, from about ½d. to ¾d. per horse-power hour (or less than this when Texas oil can be

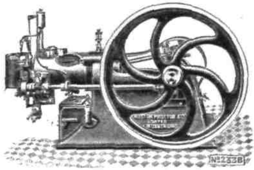


FIG. 3.—THE RUSTON & PROCTOR SMALL OIL ENGINE.

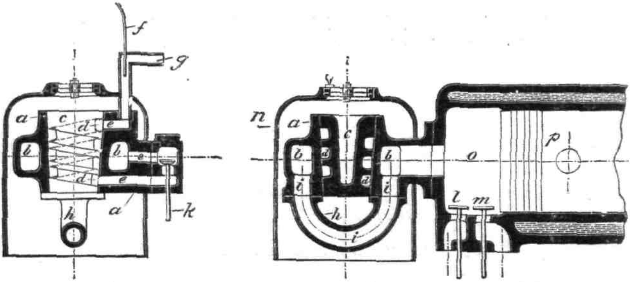
obtained and used), partly from its being able to dispense almost entirely with water supply and its labour and haulage cost, and partly from the stoppage of fuel consumption with stoppage of the engine.

Another typical engine made in the fixed and the portable form is the Ruston engine, in which the construction and operation of the vapouriser differs essentially from those of the engine previously described. The general arrangement of the engine may be gathered from Fig. 3, and the important features of the vapouriser may be explained by reference to Figs. 4 and 5.

The engine is of the four-cycle type, the four operations in the cylinder being, as already described, effected by two revolutions of the crank shaft, and consisting of (1) outstroke sucking in charge of air and oil vapour; (2) instroke compressing that

charge; (3) outstroke, *i.e.*, working stroke effected by the combustion of the charge; and (4) instroke during which the products of combustion of the working stroke are ejected, *i.e.*, the exhaust stroke.

The oil is not injected as a spray into the vapouriser, but dropped at only atmospheric pressure into a passage forming part of the vapouriser. The oil is lifted from the tank formed in the engine base by a very simple form of pump to a small measuring cistern above the engine cylinder. In this is an oil measuring thimble controlled by the governor. The tiny charge of oil measured off for each working stroke falls down a small pipe, which is seen at *f* in the diagram, Fig. 5. A small quantity



FIGS. 4 AND 5.—VAPOURISER AND CYLINDER OF RUSTON & PROCTOR ENGINE.

of air also enters this pipe with the oil. Fig. 4 is a longitudinal section of the engine cylinder with a piston *p*, combustion space *o* connected to a vapouriser *a*, *b*, *c*, *d*, with tortuous passages, into which the oil enters at *f*, and a further small supply of air at *g*. This air, drawn in by the suction action of the piston, passes at high speed round the spiral passage *d* formed round the vapouriser block *c*, carrying with it and triturating and vapourising the oil, the vapour and air or carburetted air at a temperature of about 400 deg. F. escaping from the spiral passage into the lowest passage *e*, past the valve *k*, and by the short passage *e* into the larger passage *b*, and thence into the cylinder. Here it mixes with a larger supply of air entering at the valve *l* and fills the cylinder, the

valve *l* being mechanically lifted at the proper time, so that the relative periods of admission of air and of carburetted air are predetermined. On the return stroke of the piston the charge of air and carburetted air are compressed into the combustion space *o* and the passages or chambers *b* and *i* of the carburettor, and the cycle previously explained is repeated.

To start the engine the ignition tube *i* is heated by a lamp which is afterwards removed, the heat of the compression and combustion of the working charge maintaining the carburettor, and especially the tube *i*, at a sufficiently high temperature to cause the ignition of the vapour at the moment of maximum compression. Surrounding the carburettor is a cover *n* with an air valve at the top, by means of which the temperature of the carburettor may be varied. When adjusted for working, the speed of the engine is controlled by the governor, but the strength of the working charge may be varied by varying the quantity of air entering the vapouriser.

To enable the engine to be easily started by the attendant, an exhaust controlling device is employed, which holds the exhaust valve *m* open at first during the whole compression stroke, so as to enable the attendant to get the fly-wheel into motion; it then allows the exhaust valve to close in sufficient time to retain a working charge, which is ignited, and afterwards automatically allows the exhaust valve to perform its functions normally. The makers arrange the compression and the period of ignition so that even when working at full load the maximum pressure is obtained slightly after the commencement of the piston stroke, and combustion continues during a sensible part of it. The engine consumes from less than three-quarters of a pint of Russolene oil per brake horse-power in engines of about 10 horse-power to under a pint per brake horse-power for smaller engines down to 5 horse-power.

A further example may be given of that type of engine which is made to run without external lamp for igniting the working charge after the engine has been started. This is the engine of fixed and of portable forms made by Messrs. Clayton, Shuttleworth & Co. It is illustrated sufficiently as to its particular features by Figs. 6 and 7. The fixed engine is shown by Fig. 6. Fig. 7 is a horizontal section of the engine cylinder with its

water jacket J, piston P, vapouriser V, ignition plug H S, vapour valve A, air valve B, and exhaust valve C.

The general arrangement differs materially from that of the engines previously described. The vapouriser V, Figs. 6 and 7, is in general form an annular chamber surmounted by a column E, into which oil is fed from the sight feed glass tube O, Fig. 6, by a tube T supplied by a little pump D, which is worked by the mechanism which works the vapour valve at A, controlled by

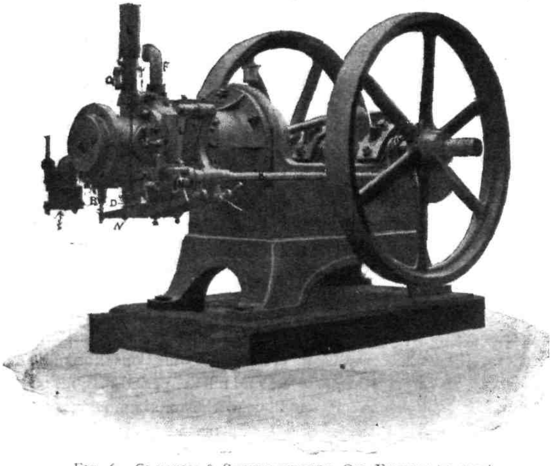


FIG. 6.—CLAYTON & SHUTTLEWORTH OIL ENGINE (12 H.P.)

the hit-and-miss governor N. When the governor pushes the vapour valve to admit oil vapour to the combustion chamber the piston P is making its outward stroke and a partial vacuum is formed in the vapouriser, air is drawn in the tube E with oil let in at O, and at the same time a charge of vapour passes into the cylinder at A and the cylinder fills up with air through the air valve B. The latter and the exhaust valve C are worked by lower levers N actuated by cams on the end of the shaft K, which runs at half the speed of the crank shaft. When the piston returns and compresses the charge, the hot vapouriser and

the igniting device S on the inner end of the plug H ignites it at the moment of maximum compression, or thereabout. The ign ition device S consists of a hollow metallic plug with holes *h* an d a cage cap holding strips of asbestos and a central steel needle. The needle and the asbestos are kept sufficiently hot by the recurrent combustion in the combustion chamber to reach the temperature necessary for ignition by the further increment *resulting from compression.*

Formerly ignition in these engines was effected by an ignition tube always kept hot by an exterior lamp. Such a

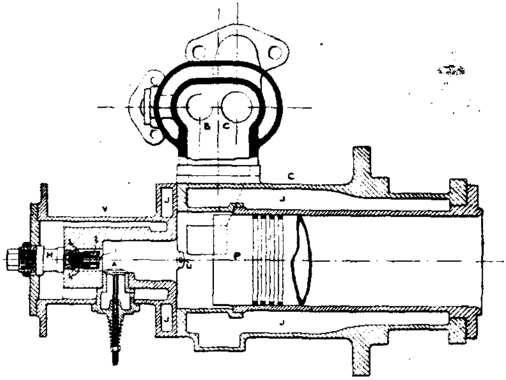


FIG. 7.—SECTIONAL PLAN OF CLAYTON & SHUTTLEWORTH OIL ENGINE.

tube is, however, now only used for starting purposes, and the arrangement of lamp and burners adopted is shown by Fig. 8.

In this a tube U, the upper end of which enters the combustion space as seen at *U in Fig. 7*, is heated by a row of Bunsen burners on a tray B. These burners are supplied with oil from an oil vessel W, the upper part of which contains air under pressure forced in by the pump with the handle O. The tray B being partly filled with petroleum, a piece of cotton waste is put into it as a wick, the burners heated, the pump worked to

force air into W, so that the oil is under a pressure of about 40 lb. per square inch, and the burners then burn the petroleum with a clean flame and heat the tube U. The engine can then be started by the ignition of the cylinder charge forced by the compression into this hot tube. After the engine has run a few minutes the pressure in the vessel W may be let off and the lamps extinguished.

The Britannia Company, of Colchester, is also now making an oil engine working without extraneous means of ignition after starting.

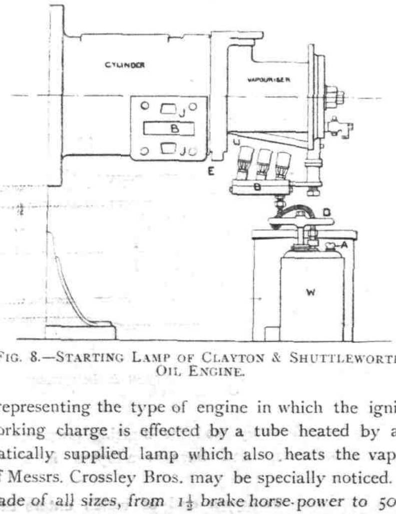


FIG. 8.—STARTING LAMP OF CLAYTON & SHUTTLEWORTH OIL ENGINE.

As representing the type of engine in which the ignition of the working charge is effected by a tube heated by a small automatically supplied lamp which also heats the vapouriser, that of Messrs. Crossley Bros. may be specially noticed. They are made of all sizes, from $1\frac{1}{2}$ brake horse-power to 50 horse-power, and in the fixed and portable forms. The cycle of operations in the working of the engine is the same as that already described, but the vapouriser is kept at a constant temperature, so that the quality of the oil vapour charge remains unaffected by varying load, and the total quantity of oil used per horse-power is not prejudicially affected by using

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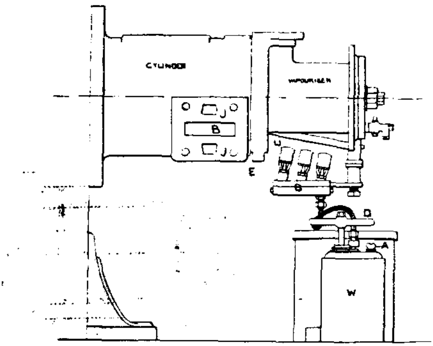

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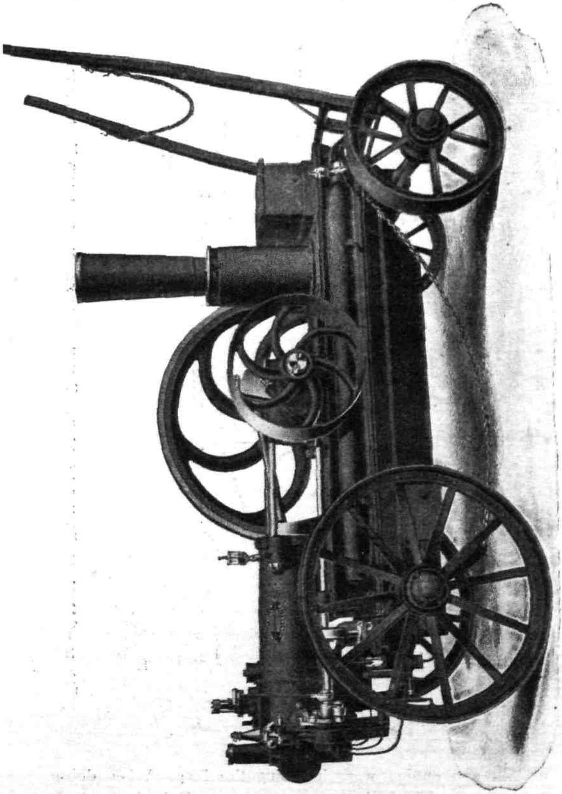
some for the lamp, and the regularity of the running of the engine is very marked. The economy and the regularity were



both shown by the trials of the Royal Agricultural Society in 1894 and those of portable engines at Cardiff in 1901. The high compression pressure used contributes to the marked

*economy obtained. Fig. 9 shows the general form and con*struction of the Crossley portable engine as used for all classes

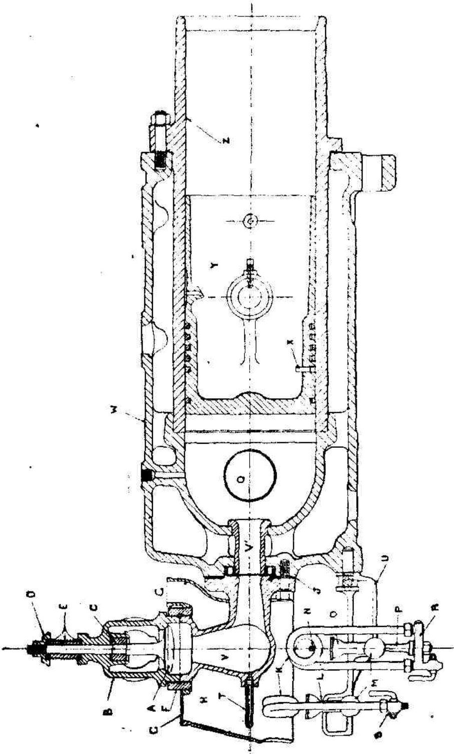


FIG. 10.—SECTIONAL ELEVATION OF THE TANGYE ENGINE CYLINDER AND VAPOURISER.

of barn and outdoor work, including threshing. When doing ordinary variable work no water, or very little, is required, except that with which the tank under the engine frame is filled before starting. In any case only a few gallons per day are

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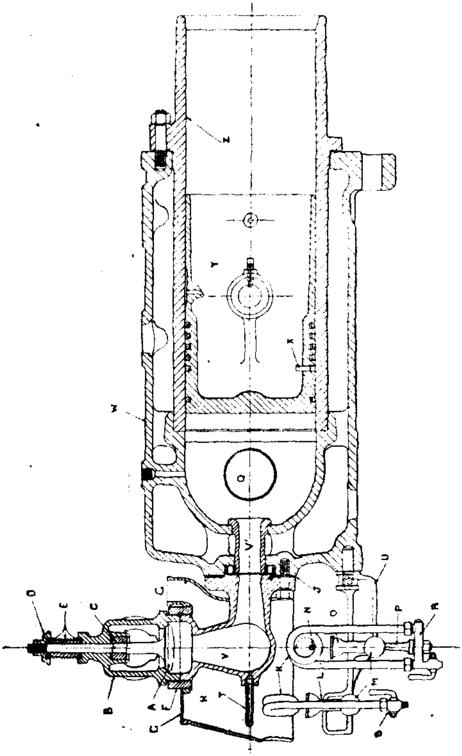

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required. The consumption of oil and the general construction of the engine itself are the same as with the fixed engines. For driving any machine at high speed, the belt may run on the fly-wheel either fore or aft, and slower speed machines from the pulley on the other end of the crank shaft.

The construction of the Tangye engine is illustrated by Fig. 10 as to its cylinder, vapouriser and heating lamp. The cycle of operations is the same as that described with reference to the other engines, but the construction differs in several respects.

From Fig. 10 it will be seen that the air admission valve A

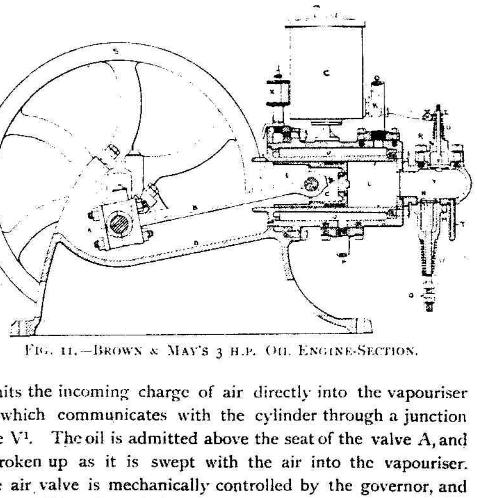

FIG. 11.—BROWN & MAY'S 3 H.P. OIL ENGINE-SECTION.

admits the incoming charge of air directly into the vapouriser V, which communicates with the cylinder through a junction pipe V^1. The oil is admitted above the seat of the valve A, and is broken up as it is swept with the air into the vapouriser. The air valve is mechanically controlled by the governor, and an air cushion piston is fitted on the stem at C to ensure steady closing of the valve on its seat. The engine is started by heating the vapouriser with the lamp N O supported on the pillar P. A small quantity of oil is put into the cup O and ignited, thus heating the pipe K carrying the burner nipple N. When this is hot oil is gradually admitted from the trunk pipe

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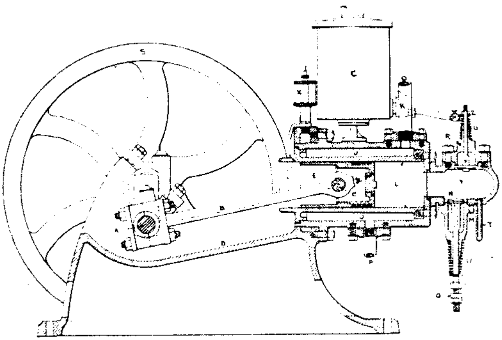

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K, vapourised in the tube and ignited at N. When thus started the flame from N heats the vapouriser and maintains the necessary temperature of the pipe K. A similar lamp is seen at K. L. S for heating the ignition tube T. When the compression stroke of the engine takes place, the tube T is filled with some of the combustible charge, and when the tube is maintained at the proper temperature the mixture in it is ignited at or near the moment of maximum compression pressure, and the whole charge in vapouriser and combustion chamber is thus ignited. When the engine has been working a short time the lamp N. O is extinguished and only that for heating the tube T kept in use The products of combustion of the starting lamp pass away through the chimney G in the upper part of the vapouriser hood, and by means of a removable cover G[1] the temperature of the vapouriser may be varied. The valve casing B is connected to the vapouriser by the screw collar F so as to be easily removed from it, and the vapouriser is connected to the cylinder by an easily re-made joint at J. These arrangements and the covered hole Q are specially made to permit ready access to parts in which carbonaceous deposit takes place.

The Tangye engine is made as a fixed and as a portable engine, and the manufacturers are now making modified forms of their engines to work with benzoline or alcohol, a type of engine which will probably in the future be extensively used for agricultural purposes.

A simple form of engine for the smaller powers is illustrated by Figs. 11 and 12 as now being made by Messrs. Brown & May, Fig. 11 being a longitudinal section of the engine, and Fig. 12 an end view. From Fig. 11 it will be seen that the crank A is connected in the usual way by the rod B and pin C to the piston E in the cylinder L water jacketted at J. The vapouriser V is bolted to the end of the cylinder and has at N an exhaust valve and at F an automatically opened air valve working in the casing R against the resistance of the spring U. At T is an ignition tube. The oil is supplied from the tank G through an air regulator at K and stop cock H, leading to an oil supply pipe and governor controlled valve seen at A, S, Fig. 12, the governor also controlling by means of the air throttle valve at D actuated by the rod R.

From Fig. 12 the method of working the exhaust valve by the lever Q will also be seen.

The Campbell engine is one of the ignition tube type, and is widely known in its fixed and portable forms. It is of simple construction and is made in various sizes, from 1 h.p. to 100 h.p., and also as a portable engine for farm and general purpose work. The distinctive features of the engine may be described with reference to the vapouriser and ignition devices as shown by Figs. 13, 14, and 15. The engine has but two valves, one the air

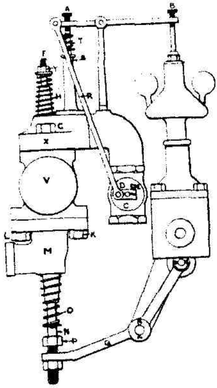

FIG. 12.—BROWN & MAY'S OIL ENGINE, 3 H.P.—END VIEW OF VAPOURISER, VALVE MOTION, AND GOVERNOR CONNECTION.

admission valve, which works automatically, and the exhaust valve at the back of the cylinder.

The air admission valve A, Figs. 13, 14, is also the oil admission valve. On the suction stroke of the engine air enters at B, and in passing the valve carries with it oil admitted by the inlet C into a small annular space D above the valve seat, and thence by the small holes E on the valve seat. The oil admitted by these holes is swept violently by the air into the chambered space surrounding the valve A, Fig. 15, at the top of the vertical vapouriser, and in the rush is broken up into spray and vapourised

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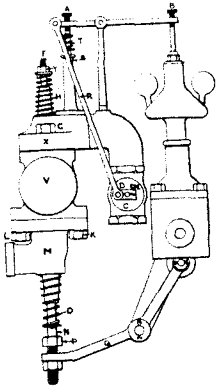

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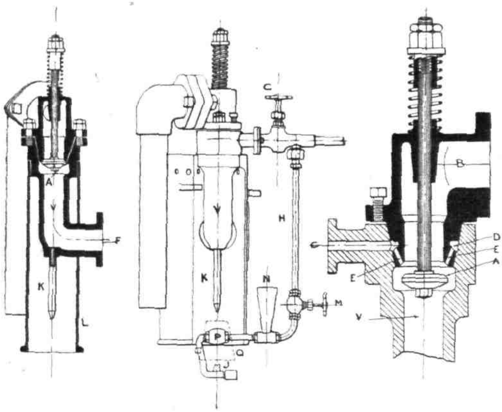
by contact with the hot walls of the vapouriser, from which it passes at F, Fig. 13, into the cylinder by a side passage into the combustion chamber, which is of simple form. The oil is supplied from a reservoir on the top of the cylinder by a small pipe, in which is a finely adjustable supply valve G, Fig. 14. From the same supply pipe a branch pipe H carries oil to the lamp burner J, which gives a long Bunsen flame. This heats the ignition tube K at the bottom of the vapouriser V and the vapouriser itself, which is surrounded by a cylindrical wind



FIGS. 13, 14, 15.—THE CAMPBELL OIL ENGINE.—VAPOURISER AND IGNITION APPARATUS.

guard L. The lamp, Fig. 14, is of the vapouriser wickless type, the oil to which is controlled by the valve M, from which it passes the air vessel N to a vapourising bulb P, and escapes. and burns at the jet J. The flame impinges upon the bulb P, surrounded by a small conical funnel Q, shown by dotted lines, which gives to the flame a columnar form, causing it to con-tantrate on the ignition tube K and the lower part of the to ouriser. The lamp is started by lighting a small quantity of A, Slowed to flow from the jet on to a wrapping of asbestos yarn thrott jet pipe. All delicate governing of the oil or oil vapour

is avoided in this engine by governing by holding the exhaust valve open. When the engine exceeds its proper speed the governor interposes a block between the end of the exhaust valve lever and a stop, so that the valve cannot return to its seat. The suction stroke of the piston finds it easier to fill the cylinder with the products of the last working stroke than to open the air valve against the resistance of its spring. No fresh working charge, therefore, enters the cylinder until the fall in speed causes the governor to raise the interposing block.

Fig. 16 represents one of the Campbell portable engines.

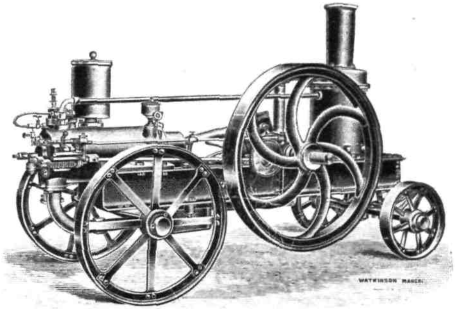


FIG. 16.—THE CAMPBELL PORTABLE OIL ENGINE.

An interesting and economical engine is that made by Messrs. Blackstone & Co. It presents a combination of the automatic ignition and ignition tube systems, and is made in the fixed and portable forms. The vapouriser is of simple form, oil being supplied to it by a small pump, actuated by a vapour valve lever controlled by a governor, which is of disc form and differs from that on any other oil engine.

Fig. 17 illustrates the special features of this engine. It is an outline view of the cylinder end, with the vapouriser and valve box in section. The engine works on the same cycle as those previously described, In Fig. 16, *a* is the ignition tube, which is in the form of an inverted bottle with the neck screwed into a passage which admits combustible mixture into it. The

larger part of the bottle is filled with asbestos. Surrounding this ignition tube are two tubes or concentric walls forming two annular chambers *c* and *d*. The air required by the engine and drawn into the cylinder on the suction stroke of the piston, enters the outer chamber *d*, where it is warmed. It then passes through holes d^1 in the upper part of the inner tube wall, and

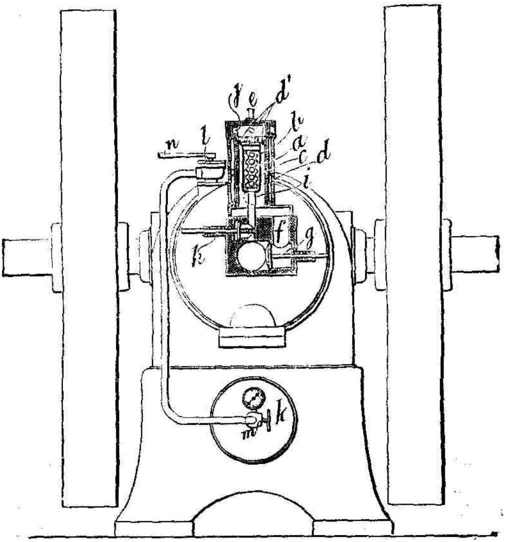


FIG. 17.—THE BLACKSTONE OIL ENGINE.—DIAGRAM END VIEW.

thence into the annular space surrounding the igniter. At the same time the charge of oil required for the next working stroke is sent by the pump into the nipple *e*, just above the top of the hot igniter. The oil is thus met by and carried and broken up into spray by the warmed and thirsty air, and then completely vapourised in its further passage down by the igniter exterior to the passage *f*, the vapour valve *g*, and thence into the cylinder at *h*.

On the compression stroke a portion of the charge is forced through the little passage covered by the valve *h*, past the valve *h* and into the igniter, which is, as before stated, filled with asbestos in a containing cage *b*, by which it is ignited. When running with a load the point of ignition (although this, as will be seen, is automatic), is controlled by the valve *h*, which is called a timing valve. This timing valve, as well as the vapour valve *g*, is actuated by the same shaft and governor-controlled cams, and is on the same side as the vapour valve, though for convenience is shown in Fig. 16 on the opposite side.

For heating the ignition tube for starting, the outer tube wall is turned half round so as to bring the port *i* at which the air normally enters on its way to the engine, opposite a similar port in the inner tube wall, thus forming a direct passage from the outside to the ignition tube. Into this passage is directed the flame of a Bunsen heating lamp, so that the neck of the igniter is raised to a sufficient temperature to fire a working charge in the cylinder. From this time the asbestos gradually becomes incandescent, and retains sufficient heat without the outside lamp to ignite the working charge at the period of maximum compression, or thereabouts, as controlled by the operation of the vapour valve *g* and timing valve *h*. The products of combustion of the heating lamp escape through holes *j*, and when the lamp is removed the outer tube wall is turned round to the position shown.

The engine is also fitted with a self-contained starting apparatus; a cylinder *k* is placed inside the foundation tank of the engine. At *l* is a valve opening communication between the vessel K and the engine cylinder. When the engine is at work, the valve *m* being opened and the valve *l* acting as a back pressure or check valve, a part of the exploded charge can pass into the vessel K, and in this way the vessel may be filled with a gaseous but inert mixture to a pressure of 250 lb. per square inch. When a sufficient pressure is shown by the pressure gauge the valve *m* is closed, and no more of the exploded working charge passes into the vessel. For starting the engine it is only necessary, after putting the crank a little above the centre line, to open the check valve quickly by the

hand-lever *u*, when the gaseous pressure from the vessel K acting on the piston starts the engine.

Messrs. Drake & Fletcher are the makers of an oil engine for fixed and portable work which in its main features is very much like that of the engine formerly known as the "Trusty" engine, and somewhat similar to that of Messrs. Clayton & Shuttleworth, but Messrs. Drake & Fletcher prefer to use a continuously acting lamp flame for heating the ignition tube, and adventitiously the vapouriser, in order to secure controllable period of ignition with suitable high compression pressure. They are also making a vertical type of engine enclosed and provided with seats and steering arrangement as an agricultural locomotive for the general purposes of barn and field work.

Messrs. J. & F. Howard are also making both fixed and portable oil engines with commendably simple and easily accessible form of vapouriser, in which a continuous heating flame is used for it and the ignition tube. Easy access to the vapouriser and port spaces, and even the combustion chamber, is of importance in most engines.

Messrs. Nayler & Co. are among those whose engines were entered in the last competitive trials of portable oil engines by the Royal Agricultural Society, and although not so successful at the trials as some of the other makers, they presented a simple, well-made engine of the lamp-heated, ignition tube and vapouriser class.

The "Gardner" engines, in their various sizes and forms, horizontal and vertical, are made for using petroleum oils of the usual densities, and also the lighter oils or petroleum spirits and benzoline, and for alcohol. Their engines are of the separately heated ignition tube type, and are of good design and workmanship. The oil supply is measured and controlled by the governor, and, like Messrs. Crossley and some others, Messrs. Gardner & Sons find the separately heated ignition tube desirable for securing the best working conditions.

"Kynoch, Limited," are the makers of what was formerly known as the "Forward" oil engine, now made with some modifications both as fixed and portable engines, and fitted with a simple form of starter, based on the principle adopted in some well-known forms of simple gas engine starters. The engine is

of the automatic ignition type, but provided with an ignition tube heated by an external lamp, which at the same time heats the separate combustion chamber. After starting the lamp is extinguished. In principle the engine is similar to that of several of those already described, but in detail it differs in important respects. No oil pump is used, the oil being sucked up as required on the suction stroke of the piston, the quantity varying automatically with the governor control of the vapour valve between the vapouriser and the combustion chamber. The vapouriser is of the vertical baffled path type, separated from the cylinder by a neck carrying the air inlet valve, the position and cooling effect of which are adopted as the means of preventing the pre-ignitions otherwise likely to occur, especially with a sufficiently high compression for economical working.

Fig. 18 is from a photograph of the "Kynoch" portable engine, which is well made and of several sizes. Trials made at the works of the makers of one of these engines of 7 b.h.p. are said to have shown a consumption of only 0·675 lb. of oil, viz., Russolene, per b.h.p., although the mechanical efficiency was only 70 per cent.

Among other makers of engines of the automatic ignition class are Messrs. Edward Humphreys & Co., in whose engine, the "Atlas," a pump is employed to force the oil into a spray box, the quantity of oil injected being controlled by a governor. The spray is received in the combustion space near the air admission valve, and on maximum compression is fired by an internal ignition tube, the temperature of which is maintained by the heat from combustion absorbed by a cast iron inwardly projecting hat, forming part of the combustion chamber and carrying the tube.

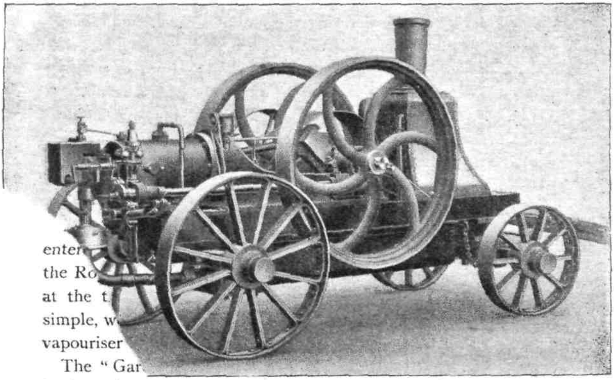
The Newton Electrical Works Company, Taunton, and Messrs Petter & Sons, Yeovil, are also makers of engines of the smaller sizes in this class.

An engine differing in construction from any of those described, and which has the merit of being economical on half load, is the Robey-Saurer engine made by Robey & Co. It is of the exterior vapouriser, ignition tube and heating lamp type, and is easily accessible in all its parts. The vapouriser is of simple form, the oil is supplied to it by a small governor-controlled pump, and a

vapour valve is placed between vapouriser and combustion chamber. The engine is made in various sizes to 50 h.p.

Several of the engines herein described will work with some crude oils, and many with the heavier oils, such as Russolene, but those using the former require to be very frequently opened up and cleaned out. Ordinary oils, such as Water White, Tea Rose, and Royal Daylight, are preferred.

Comparatively recently, oil engines of quite a different class to those hereinbefore described have attracted a good deal of



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well-known forms hese motors has been made by the "Ivel Agri-

cultural Motors, Ltd.," in the form of a light tractor capable of hauling a light scarifier or a double-furrow plough, a sheaf-binding reaper, or driving a threshing machine.

Mr. John Scott, of Edinburgh, has also applied petrol motors to cultivators and drills.

Sufficient experience has not, however, been yet obtained to make it possible to speak positively of the economic value of the oil engine or spirit motor for field work. Experience in the past with steam engines for field tractor purposes does not necessarily apply to the oil motor tractor and new conditions and modes of working that may commend themselves. The failure of the steam engine is not necessarily indicative. It may be even yet that the oil engine of, say, 15 b.h.p., may perform, by the simple haulage of gang ploughs, that which the steam tractor failed to do; or may again open the way to the co-operation of two or more farmers of a district for the employment of the windlass and self-moving anchor and light ploughs—light as compared with the six-furrow ploughs of the steam system. The oil engine with electric ignition may pave the way for doing other field work by motor, but even at this day this is a matter for experiment, and if some of the well-to-do estate owners who can afford to experiment would do this, as others have developed the motor carriage by buying high-price cars, they would be doing something of interest to themselves and of value to everyone.

They may feel encouraged by that which has already been done by the Ivel and by the Drake & Fletcher motor, the former of which was last month awarded a gold medal by the Upton-by-Chester Ploughing Association for work done during a competition, an award which confirms the opinion formed by other associations and observers, including the North Kent Agricultural Association.

The Ivel tractor weighs only about 28 cwt. It is an outcome of the motor car, and is fitted with a petroleum spirit motor of about 14 h.p. It is driven and steered by one man, and, when ploughing, one man is required on the plough. At Upton-by-Chester its speed was about three miles per hour with a double furrow plough working six inches deep. If the performances in ploughing can be repeated on heavy land in bad condition at

cost for fuel and labour similar to the cost hitherto on medium land, the tractor for ploughing will soon come to the front if the cost of higher skilled labour has been taken into account, and provided the cost of depreciation, maintenance, and renewals are not found too high. It is a subject for a prize competition under the auspices of the Royal Agricultural Society.

For other than field purposes, however, the experimental stage has long since been passed, but care must be exercised in the selection of an engine for a given purpose, and it must be properly proportioned to the work to be done. It is always well to have enough power, but oil engines are generally much less economical on three-quarter or half load than on full load, so that it is desirable that the engine should be properly proportioned to the work, and this should be properly ascertained and not guessed at.

Under the head of agricultural purposes I have included dairy purposes, so far as the consideration of power requirements are concerned, and, in conclusion, it may be said that for nearly all these purposes the oil engine offers many advantages as compared with steam engines of small sizes and for variable work. Whenever the farmer or dairy owner requires power for machine-driving purposes, especially when wanted irregularly though frequently, or when wanted only a few hours per day, the oil engine is the most suitable motor. Its superiority results from several causes other than economy per horse-power while running, and although I have not thought it necessary to give figures as to oil consumption, except generally, and have personally tested only a few of the engines named, I am satisfied as to the economical working of several of them. The superiority, in brief, is based on readiness and convenience, and this superiority will hold good even where occasional work has hitherto been done by horse gears.

These remarks will not, however, apply in many cases with regard to threshing on the English system or where the farmer does not own the threshing machine. This is more cheaply done on the hire system, as at present, but where fixed barn threshing is done the oil engine will come in.

W. WORBY BEAUMONT, M.Inst.C.E.

WEEDS AND THEIR SUPPRESSION.

Any plant growing where it is not wanted is a weed. It matters not if the plant in question is a useful one; so long as it is out of its place or occupying ground which is intended for the growth of another crop, the plant for the time being must be classed as a weed. According to this definition wheat, potato, or rape plants among other crops are weeds.

The term, however, is associated usually with plants such as thistles, couch or charlock, which are not cultivated intentionally, and against which a good farmer wages a relentless war.

It is not needful to point out in detail the many ways in which weeds interfere with profitable husbandry. The most serious objection to them can be stated in a few words. In the first place, they absorb manures and water from the soil which would otherwise go to nourish and increase the yield of the crop among which they grow. And, secondly, they crowd the crop, and screen it from getting an adequate amount of light for sturdy development and proper assimilation of the soil and air constituents, which is so essential for healthy growth. This screening effect, of course, is most damaging to the early life of seedlings, and is especially injurious in the case of crops of slow growth and those with small delicate leaves. The necessity for a clean seed-bed for lucerne and carrots, for example, is commonly understood, even if the practice is not always carried out.

Every farmer recognises that it is not possible to obtain the best returns from his land when weeds are allowed to grow unchecked. Few, however, have any definite idea of the diminution of yield brought about by these robbers of food, water, light and air. Last season I had many opportunities of examining the differences of yield on land which had been hoed

more than once, and portions of the same field on which hoeing had been stopped by continued rains. The results were very striking; in many cases the moderately weeded areas carried from 40 to 50 per cent. more crop than those on which the weeds were unchecked.

Many weeds, such as bindweed and cleavers, pull down cereals or assist in their downfall, and render harvesting difficult and expensive.

Others harbour or favour the development of insect pests, as charlock does the turnip "fly"; or act as temporary hosts for rusts, mildews and other parasitic fungi which subsequently spread to cultivated crops.

Moreover, the pecuniary value of samples of cereals is reduced by the presence of cockle, garlic, cleavers and vetches, and similar reduction in market value of hay and other farm produce is brought about by certain weeds or their seeds.

Several weeds taint the milk of cows which have fed upon them, and some are poisonous to stock, perhaps the most objectionable in this respect being meadow saffron and water hemlock.

Before we can hope to deal intelligently with the suppression of weeds it is essential, among other things, that we should have a clear conception of the way in which weeds obtain access to the farm and the methods by which they are spread among cultivated crops.

The manner in which the seeds of plants are distributed is very varied. The commonest natural process to which the farmer should pay most attention is the distribution effected by means of the wind. The seeds of some of the commonest weeds are, like those of the poppy, so small and light that they are readily blown away from the parent plant. In other cases, such as the thistles, groundsel, dock, and many sorts of inferior grasses, the seeds have special parachute-like apparatus, or other arrangement, of fluffy hairs and flattened wing-like projections, by which they are rendered buoyant, and easily carried about in a light breeze.

In addition to these natural methods of distribution, weeds are, very frequently, more or less directly sown over the land or brought on to the farm in inferior hay, or in farmyard manure and stable dung. Screenings from threshing machines sweepings

of barns and hay lofts, refuse from impure samples of oats, and similar rubbish containing the seeds of weeds, often find their way in the ordinary course of things to the manure heap, or are deliberately thrown there in the belief that any seed which may be present will be destroyed by the heat of fermentation and other chemical changes going on in the heap. A great many seeds, however, are not injured by such treatment; in some instances the seeds germinate better after being subjected to the processes going on in a manure heap, or after passing through the stomach of an animal.

The use of impure samples of seed is another very potent means of introducing weeds to a farm. For example, the presence of even 1 per cent. of dock seed in a sample of red clover means *ten dock plants per square yard* all over the field wherever such a sample is sown at the ordinary rate for leys, and yet the farmer not infrequently yields to the temptation of purchasing imperfectly cleaned seed solely on account of its low price.

It is probably no exaggeration to say that for every farmer who persistently buys only the best samples he can obtain, there are ten who would purchase samples at 3d. or 4d. per pound less with all their faults, when it would in some cases have been false economy to use such seed even if it were a gift.

The amount of imperfectly cleaned seed on the market, especially after unfavourable seasons such as we have just experienced, is much greater than is generally imagined, and it would well repay the farmer who is anxious to avoid unnecessary labour, expense and worry, to pay closer attention, and give more thought to this side of the weed question than has hitherto been the case.

Having obtained some insight into the manner in which weeds are spread, it is possible to devise some general principles upon which their suppression must be based. It is, however, needful to emphasise the fact that, whatever methods are proposed, they are little or no use unless faithfully carried out. Good recommendations are valueless unless they are acted upon, and more than ever is it essential that prompt and vigorous measures should be adopted now that labour has become scarce in many districts. Systematic well-timed effort is ten times more efficient than haphazard and occasional attempts, and the outlay is more

than repaid by improved yield of crop and enhanced quality of the produce.

1. The first and most obvious mode of suppressing weeds is to prevent their seeding. When it is recognised that an ordinary charlock plant produces more than 1,000, and a moderate-sized poppy at least 10,000 or 15,000 seeds, the force of the adage that "one year's seeding is seven years' weeding" is obvious, and to allow the production and distribution of these seeds is to court trouble.

The mischief is greater than it appears at first sight, for many weeds are remarkable in producing seeds which do not germinate uniformly. Some of these may remain in the soil for one or more seasons without germinating and come up subsequently at very inconvenient times. To be really efficient the prevention of seeding must extend to the weeds growing in hedgerows, on roadsides and waste places near at hand, as well as to those on the cultivated portions of the farm.

Not only must we prevent the seeds of weeds from being sown naturally, it is equally necessary to avoid sowing them in samples of grass seeds, clover, and cereals. And at the same time we must be careful about the disposal of screenings, sweepings of barns and haylofts, and other rubbish likely to contain them. Such refuse is best burnt, or, at any rate, disposed of in such manner that it will not find its way to the manure heap and finally to the land.

In cases where manure is suspected of containing living weed seeds, it is the lesser of two evils to apply it to pastures and meadow rather than to arable land.

2. On foul land where the seeds of weeds are abundant, deep ploughing so as to bury the rubbish is sometimes practised with a certain amount of success. Many seeds rot when buried deeply; others, however, remain dormant without losing their vitality, and may be subsequently brought to the surface, where they grow and cause mischief. Burial in this manner is therefore generally inadvisable, as it only delays the worst troubles and does not get rid of them altogether. Shallow cultivation and the preparation of a good tilth, so as to encourage germination of the seeds, is a better plan, for as soon as the seeds have sprouted the young plants can be

destroyed by further stirring of the soil. Repeated thorough cultivation of this kind, taking care to keep the seeds near the surface, will clear the ground of many troublesome annual and biennial weeds, such as poppy, charlock and some species of thistle.

3. To destroy perennials, such as couch, bindweed, and creeping thistle needs careful and well-directed effort. These plants are propagated by bits of underground runners with buds upon them, and it is easily possible by irregular and partial cultivation to break up the runners and spread the pieces all through the soil, thus making matters worse than before.

Shallow ploughing, followed by thorough harrowing and subsequent collection of the weeds with cultivators or harrows when the soil is in the right friable condition, is an excellent practice where such perennials are concerned. Or the weeds may be brought to the surface and left to the drying effects of wind and sun.

4. Total removal of weeds is the most efficient means of destroying them. This may be accomplished by hand pulling, digging with fork or spade, or collecting by means of the harrow after being loosened with the plough and other implements. Some of these methods are expensive, and are only adopted in special cases where other plans are inapplicable. In every case where weeds have been collected by hand care should be taken to destroy them effectually; the practice of throwing them on one side, into ditches or under hedges, is a reprehensible one, for docks and thistles so treated are sometimes able to perfect their flowers and seed.

5. All weeds whatsoever can be destroyed by judicious cutting with spade, hoe, or scythe. Reckless and ill-timed cutting may be, however, a potent means of encouraging what we desire to suppress.

Many weeds when cut near the ground send up several stems from buds on the rootstock, and this is especially the case among perennials, such as nettles, thistles, docks, bindweed and other common weeds. These secondary shoots are produced at the expense of food stored below ground in the previous season of growth, and their growth is therefore exhausting or

weakening to the plant as a whole. If when these shoots are produced they are cut off immediately, permanent loss or damage is done to the plant, and repetitions of the process are certain to end in total destruction, no matter what the weed may be.

To be successful, it is necessary that the cutting should take place early in the season and throughout the summer, as often as the new shoots are produced. If, after the first cutting, the new shoots are allowed to grow and remain for some time, say till late summer, the work is useless, for during the summer the manufacture of food is carried on by the new shoots, and the material made is stored below ground for use in the following season. To cut off the part above ground after such storage has taken place is too late and is obviously a futile process.

Much attention should be given to the principle underlying this method of destroying weeds, for conflicting statements are very frequently made in regard to the efficacy of cutting weeds with scythe or sickle. The success or failure depends upon the time at which the work is carried out and repetition at correct intervals. It may be taken as an axiom that so far as the destruction of perennials is concerned, cutting once, whether early or late, is valueless. Cut early, and follow it up as often as possible, is the correct plan. This carried on for a couple of seasons will effectually destroy practically all weeds.

Some plants can be destroyed by once cutting with hoe or spud if the real root is severed, for the portions of the root left in the ground have no power of forming new leafy shoots. A carrot, for example, when cut through the root does not sprout again. There are a few plants, however, such as docks and dandelion, which are able to produce buds and stems from their true roots, so that total removal of the whole plant is necessary with these, or repeated cutting in the manner first described.

6. A number of weeds, such as rushes, sedges, and horsetails, are indicative of acid or sour conditions of the soil, which can only be remedied completely by draining. Where this is not possible, the next best thing to be done is to look carefully

after the proper cleaning out of ditches and watercourses, so that the free draining off of water is not impeded.

7. Very considerable changes in the character of the herbage on pastures, and of the weeds on arable land can be induced by the application of certain manures, artificial fertilisers, salt, lime, and other materials.

Nitrogenous manures stimulate the growth of grasses which tend to choke out buttercups, cowslips, and many other weeds or less useful plants. The sour condition of the surface soil can be partially remedied by a good dressing of lime or chalk, and lime is more or less a specific against sorrel, corn marigold, and a few other weeds. The herbage of most pastures on stiff clay land is very greatly improved by 5 to 8 cwt. of basic slag per acre.

In fact, the application of any kind of manure makes some change in the herbage; certain plants being encouraged and others checked by it. Careful observations and records of these changes are much needed.

8. Close feeding with sheep will often keep in check certain plants, such as yarrow and ragwort, and prevent them from seeding and spreading over wider areas.

9. Lastly, certain chemical substances, especially the sulphates of copper and iron, have been found useful in destroying weeds. A 3 per cent. solution of copper sulphate, at the rate of 50 gallons per acre, sprayed on charlock when it is young kills or very materially damages the weed without affecting the cereal crops, wheat, barley, or oats. It is, of course, useless for destroying charlock among turnips, for it damages the latter as easily as the charlock.

The destruction or suppression of weeds, from the above brief account, is seen to be a complicated and many-sided question, which needs much thought and well-directed effort if success is to be ensured. To a certain extent individual species of weeds sometimes require particular treatment, yet it is certain that the general practices described will have very beneficial effects if faithfully carried out with energy and an unsparing hand.

JOHN PERCIVAL.

BEE-KEEPING FOR SMALL FARMERS.

At a time when the term "Agricultural depression" is familiar to everyone, it will perhaps strike thinking men possessing knowledge of the subject as curious that the class of agriculturist known as the small farmer has never had his attention seriously directed to the advantages of bee-keeping as a means of adding to his income. Our own impression is that if the possibilities of what can be done with a few hives of bees are stated reasonably, in plain terms, without any exaggeration, and proved by facts and figures, we shall have not a few small farmers who include bee-keeping in their ordinary work, and find it the most profitable branch of the farm.

But, in marshalling our facts, we must begin by stating two indispensable conditions, failing which success is impossible. These are :—First, a suitable location ; and, second, some natural aptitude for bee-management on the part of the farmer himself.

Regarding our first proposition, the adage about "taking coals to Newcastle" may be reversed by saying "it is no use starting to keep bees with the view of profit in a district where no bee-forage is grown." Not only so, but the *quality* of honey yielded by the nectar of the flowers from which the main supply is harvested is an important factor in the question. In other words, there are many counties and districts in this country where, in an ordinary season, the honey is of such excellence as to bring the highest price of the year ; while in other parts, though a plentiful yield is secured, the produce is so inferior in quality as to be hardly saleable for table use.

It must also be borne in mind that the main honey crop is gathered from fields, fruit orchards, and heather hills ; all other sources of supply, including flowers grown in gardens, are merely subsidiary to the above, and need not be taken into account at all by the bee-farmer. To define clearly the good bee-forage

of this country, we may say it includes, in field crops, white clover, sainfoin, alsike, trefoil, lucerne, white mustard, vetches and buckwheat; their respective values being taken in the order given. The orchard or fruit crops comprise raspberry, gooseberry, currant, plum, cherry, apple, pear, &c. To these may be added that from the heather, which forms a valuable adjunct to the bee-farmer's summer crop, as affording a second harvest of first-class honey to those within reach of moors and hills covered with the common ling (*Erica vulgaris*) or the bell-heather (*E. cinerea*). Lime trees—where grown in good numbers—and hawthorn are also helpful in some seasons as yielding honey very abundantly.

The second condition is no less important than the first, viz., a natural aptitude for bee-work. Some men are totally unfitted by nature and temperament for bee-keeping, and for such it is mere waste of time trying to learn. The good bee-man is somewhat akin to the bees themselves, in being cleanly and orderly. He must also be quiet and gentle when manipulating hives, as anything like rough handling is soon resented by the bees; while the man whose habit is to "bang things about" —to use a homely phrase—will soon find out his mistake, and this is the one to whom the above deprecatory remarks apply.

On the other hand, if our small farmer possesses in any degree the necessary natural aptitude, he will have no difficulty in mastering the few essentials required to make a successful bee-keeper. But he must begin aright by acquiring some elementary knowledge of the natural history of the honey-bee, in order to arrive at the "why and wherefore" of the "happenings" which occur in the various stages of bee-life. He must learn the difference in value between strong colonies and weak ones, and the number of bees (approximately) required to make up the former, together with the conditions implied in what is termed "a prosperous brood-nest." Then, and closely connected with the latter, comes the supreme importance of having his stocks headed by young, vigorous, and prolific queens, because the queen—or mother-bee—alone lays the eggs from which the whole population of the hive is produced and maintained. These details, together with a few particulars connected with the several phases of bee-life (from egg to

perfect insect), and the time occupied in each stage, can be acquired by any intelligent man who devotes an hour's reading to the subject. Roughly speaking, the metamorphosis of the worker-bee may be stated in a few words, as follows:—The egg hatches in three days; the larva is then nursed and fed for about five days, when feeding ceases, and the cell containing the larva or grub (now in the nymph stage) is sealed or capped over, and it remains so till the twenty-first day, when it emerges a perfect bee. Drones mature in twenty-four, and queens in from fourteen to seventeen days. The duration of the worker-bee's life is measured less by length of days than by the amount of labour done. In the busy gathering time of summer the insect is worn out and dies after about six weeks of toil; but bees born in autumn, after the gathering season is over, will live more than as many months. In fact they form the field-foragers in early spring of the following year.

In closing this part of the subject, and prior to dealing with the practical work of an apiary, it must be understood that a good text-book on bee-keeping is indispensable. The scientific side of apiculture, though full of interest to those whose taste or inclinatibn lies that way, may be put aside, except so far as acquiring a brief but sufficient knowledge of the few diseases bees are subject to. The most suitable work for the purpose we know of is *The British Bee-Keepers' Guide Book*, by T. W. Cowan. This little manual, costing 1s. 6d., contains everything the bee-keeper requires to know. It is written in simple concise language, with no superfluous verbiage, and illustrated with numerous engravings explanatory of the text, so that its teachings can be understood and carried out by anyone possessing ordinary intelligence.

Pre-supposing, then, that the "conditions" already named as being "indispensable" are favourable, that the few hours of preliminary reading prescribed have been gone through, and that our farmer friend has resolved upon making a start with bees, a suitable part of his little farmstead must be selected whereon to locate the hives. It should be as far away from public highways as possible, and, if convenient, in a quiet place, sheltered from high winds, where the bees are not likely to be interfered with by men or animals. The hives must be securely

fenced off, if situate on land where cattle are accustomed to feed. They should also be not so far away as to prevent those engaged about the dwelling-house from seeing when swarms are in the air. If the hives can be so placed as to afford a free bee-flight towards the open country, while the bee-keeper has room to work at the side or in rear of them without interfering with the flight of the bees, it is mutually advantageous to them and to the bee-keeper.

One of the most reliable arguments in favour of combining apiculture with small farming lies in the fact that the bee-keeper can time his work so as not to interfere unduly with the attention needed for harvesting his ordinary agricultural produce. Moreover, much valuable help can be rendered by a farmer's wife who is so disposed, and many instances are recorded in which women make most successful bee-keepers, when helped by their husbands in the merely mechanical labour of hive-making and such manual work as is suitable for men only.

Another item for serious thought is the outlay involved in providing the necessary appliances and stock required for the work of a small apiary. Certain of these things must, perforce, be purchased; among them, in addition to hives, we may include sections, frames, comb-foundation, honey-extractor, bee-smoker, super-clearers, and possibly a few syrup-feeders. But the main point is whether or not our small farmer possesses sufficient mechanical skill, combined with the needful inclination, to make his own hives during the long winter evenings when out-door work is out of the question. That many men—gardeners, artisans, and others who can handle joiners' tools fairly well—do this is certain, and if we may include among them the farmer who starts with bees, the initial outlay will be of course considerably reduced. But he must always bear in mind the importance of accuracy in measurements, seeing that it is absolutely essential for efficiency in working that roofs, lifts, floor-boards, surplus chambers, and all the various loose parts of hives be interchangeable with each other.

It is certain, however, that many will, for some reason, either be unable to make their hives or prefer to purchase, and to these we say, do not on any account be persuaded to adopt a

hive that is not made to take the "standard" frame of the British Bee-Keepers' Association. In urging this precaution we refer only to the internal dimensions of the hive's brood-chamber or body-box, and to the *outside* measure of the frame. Thickness of top-bar and width or strength of side and bottom bars are of less moment and may be left to individual preference, but the outside measure of the frame must be 14 in. long by 8½ in. deep. Before deciding on the "type" of hive to be used, a personal visit to a hive-maker of repute—or preferably to a Bee and Honey Show, where there is a large and keen competition among leading bee-appliance makers whose goods are on view—will be very useful. Then, after a choice is made, a few hives (only a few) may be ordered in the flat, ready for nailing up at home. Such a hive would, of course, not include surplus chambers, but would simply consist of stand, floor-board, body-box (fitted with ten or eleven frames), quilts, lift, and roof, and may be had in the flat at prices varying from about 6s. or 7s. upwards.

On the other hand, the man who decides to make his own hives should select the one he prefers, and purchase it from a good maker as a pattern from which to work. This will be found true economy, as enabling him to choose the best kind of wood for the purpose, and reducing the cost to that of material only, except for frames, which must be machine-made for accuracy, and which may be purchased in the flat, dovetailed, and ready for putting together, at less than one penny each.

Some bee-keepers, to whom the saving of cash means much, have constructed strong, useful hives—good enough for all practical purposes—from such unpromising materials as used boxes, which latter cost only a few pence each.

An instance of this is recorded in the *British Bee Journal* of April 30th last year, where we find described in full detail, with working measurements of each part, a complete frame-hive c. except for the surplus-chambers, in which honey is stored for su moval when full). It comprises *stand*, *floor-board*, *outer-case*, to ...*-box* (or brood-chamber), *lift*, and *roof*. These various parts high made from (1) an egg box, (2) a lobster box, and (3) a shelte ...ker oats" box, the three boxes costing 1s. 1d. It would interfe ...p too much space to print the full particulars of construc-

tion and give measurements, but anyone interested may obtain the *Bee Journal*, referred to, from the office, 10, Buckingham Street, Strand, for three halfpence, post free.

Another important question for the farmer is how to prepare his bee-produce for market. We say this because the value of a good crop of honey is raised or lowered very considerably by the way in which it has been prepared for sale. In considering this point it must be remembered that home-produced honey has to compete with the foreign article put up by the skilled packers of the edible goods which make up the attractive displays seen in tradesmen's windows. The honey prepared for market by the farmer's wife of twenty years ago would make a sorry show nowadays. The most luscious combs of honey cut from skeps and carried to market on a large dish, or the run-honey in a big brown jar to be baled into the customer's honey-pot, are things of the past. The business of marketing honey has undergone a complete change, and in this connection the useful part borne by the women-folk is more than ever conspicuous. The wives of our best bee-keepers to-day generally do most of the work of "glassing" and "lace-edging" sections of comb-honey, and bottling-off and labelling extracted honey for market, and do it well. In fact it is a task a woman excels at if once shown how it is done.

A visit paid to a good honey show is an object lesson in the up-to-date preparation of honey for market which our farmer friend and his wife should on no account miss, for it is of little use securing a good harvest of honey unless it can be profitably marketed.

The extracting and cleaning of bees-wax is also usually done by the bee-keeper's wife. It will thus be seen that a large part of the work is as well suited for feminine hands as for those of men.

Bees, like all other live stock, require attention on the part of their owners, but with regard to feeding they are altogether different from other stock, seeing that the food-stores they provide for themselves are in a great measure appropriated by the bee-keeper. On the other hand, neglect of the apiary means loss to its owner, and not seldom serious damage to neighbouring bee-keepers. We refer to the disease known as "Foul Brood" (or

"Bee-Pest"), to which bees are subject. Those who do not grudge the necessary trouble required in order to keep their bees healthy can do so, as has been proved by the experience of well-known men in the craft; but without care disaster is certain to follow.

In this and many other sections of our subject we must rely on readers seeking, in the pages of a text-book, for fuller details regarding such items of practical bee-management as have not been made sufficiently clear. It is impossible in a short paper to do more than indicate the work needing to be done, without detailing fully how to do it. Especially is this true with regard to foul brood, which, being an infectious disease, must be studied in order that the best method of treatment and the nature of the remedies recommended may be fully understood and the disease successfully coped with.*

Our few closing remarks may be devoted to a glance at the financial aspect of the case, for this is the main point to be considered. The question, "Does bee-keeping pay?" has been made familiar by its frequency among those desirous of making a start, and the replies have, of course, been *pro* and *con*. But if the two indispensable conditions named at the outset are assured beforehand, we unhesitatingly assert that, for the small farmer, bee-keeping will pay well. The amount of capital required would in any case be less than for the purchase of a horse or a cow, while the percentage of profit would more than double that of any other department of the farm. In the case of a working farmer of small means, he can make a start with one or two hives without investing any appreciable capital at all.

The published reports from bee-men who keep an accurate account of income and expenditure show that a good profit can be made; but, in taking up bee-keeping as a purely business matter, it needs, as we have said, a good location. No imaginative statements have been made regarding what has been done by others. The facts are recorded in print, for,

* Leaflet No. 32, on "The Treatment of Foul Brood," may be obtained free of charge on application to the Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

week by week, in the *British Bee Journal*, we see depicted "Homes of the Honey-bee," photographed from life. British bee-gardens are shown with their owners at work in them, and the bee-men seen, in giving their experiences, tell what the bees have done for them.

Need we say more than advise the farmers to see pictures and judge for themselves whether or not it is worth while to try if a few hives of bees on their farms will not add to their pleasure in life while appreciably adding to their income.

W. BROUGHTON CARR.

Editor, British Bee Journal.

MINOR AILMENTS OF POULTRY.

There are endless causes of disease among poultry, chief among them being·

Careless breeding,
Damp,
Draughty houses,
Filth ;

the last mentioned being by far the worst of all.

Careless feeding is another, and especially so when food is left lying about on the land to become contaminated by the droppings of unhealthy birds. The waste of food is costly—for it is but seldom that birds will eat stale food—but expense is the least part of the evil ; the souring of the land with its attendant train of disease and death is the greater.

We are careful with our horses, our cattle, our sheep and our pigs ; but poultry may die of the deadliest and most infectious diseases, and may be left lying about to spread disease germs wholesale, and no one seems to care a whit. The remedy is of the simplest. Isolate sick birds on the first appearance of any disorder, and burn all dead birds : the risk of infection is thus minimized at once.

Ill-ventilated, draughty houses, leading, as they do, to outbreaks of cholera, colds, consumption, and other ailments, are a fruitful source of loss to the poultry yards of England. Seeing the immense number of uses to which eggs can be put, and the great facilities we have in our markets being at our very doors, poultry-keepers should take heed lest, by neglecting advice and opportunities, the industry be killed, so far as the home producer is concerned, by the more careful foreign business men with whom we poultry-keepers already have to deal.

In the first place, it must not be forgotten that the most successful breeders and fatteners never keep diseased birds about their yards (unless in the case of very valuable stock which will pay for the curing); it is generally cheaper and wiser to kill and burn the sick bird straight away; but if your birds be valuable ones, isolate and treat them according to the directions given in this article, and you will then probably cure about 70 per cent. of them.

To be sure of making a larger profit year by year, you should remember and observe the following rules:—

1. Never breed from birds which have been cured, apparently, of roup, dropsy, liver disease, or consumption;

2. Always be careful to give your stock plenty of clean, fresh water at least once a day, so that they need not drink any filthy stuff they may come across;

3. Be sure that your poultry houses are well built and thoroughly ventilated, but are not in the least degree draughty;

4. Be most careful to see that these houses are kept clean and sweet, and free from vermin of all kinds;

5. Breed only from those of your hens which lay best—weed out each year those which, either by reason of the small size of their eggs or from their inferior laying capacities, cannot be termed really profitable;

6. Remember that brains and energy, coupled with a careful attention to details, are more valuable than the practice of false economy, whether as regards money or time;

7. Above all else, remember that unless your birds have a proper supply of clean water and suitable foods, they cannot lay eggs, however well they may have been bred for the purpose;

8. Do not forget that, as birds have no teeth, and in order that they may properly masticate their food, and so keep free from indigestion and liver disease, hard grit of some kind must be found for them. The cry, "My birds can get grit for themselves," is too often untrue; fowls are not quarrymen and they cannot get more grit than is actually on the surface, while only certain sizes of this are of any real good.

Poultry-keeping is a national industry, not a mere hobby to be dabbled with in one's spare time, and to succeed it must

receive that proper business attention which, as a great national asset, it most certainly deserves.

In this article I am taking the lesser ailments seriatim, and those of my readers who will obtain leaflets Nos. 57, 58, 67 and 78, and the leaflet (25) issued by the Department of Agriculture and Technical Instruction for Ireland, will see the similarity of symptoms in the cases of cholera, diarrhœa, dysentery, and liver complaint. The gist of the whole matter is that there should be no epidemic of any of the more deadly diseases if the first symptoms are carefully noted and the sick birds put away by themselves at once ; while if the few rules given above be observed by all poultry breeders, big and little alike, and if dirty floors and food troughs and waste of food be tabooed, not only will there be no disease, but there will be very greatly increased profits, and it will be found that utility poultry-keeping, like dairying, can be made to pay, and to pay well.

In no case should the male bird be anything but pure-bred ; to attain the best results the hens also should be pure-bred, or, at any rate, only first crosses. Mongrels often lay well, but they may have the germs of disease lying dormant within them and now that there are so many hundreds of persons breeding healthy, pure-bred birds solely for utility purposes, anyone can obtain eggs or chicks from reliable laying strains at but small cost.

Spices for fowls are but the same as condition powders for stock, exceedingly useful as medicines but more than deleterious when given every day. The spring of the year is the natural laying season of the fowl ; no artificial aids are then required by the hen, and, if given, only tend to deplete the owner's pockets and to spoil the constitution of his birds. On the other hand, when moulting, fowls do require doctoring a little, and they need more and better food to make up for the animal energy expended in the making of the new feathers.

APOPLEXY usually comes from overfeeding on starchy foods, and can but rarely be cured. If the bird be very valuable, proceed as follows :—Open the large vein under the wing and hold the bird's head under a cold water tap for a minute or two; then, if it shows signs of recovery, feed it sparingly for a few days

on soft, light food—*giving no hard grain at all*—and a dose of five grains of bromide of potassium each day.

Do fowls bear purging? If so, calomel is a useful purge in apoplexy. Probably about $\frac{1}{8}$th grain powder every day.

Reduce the amount of food given to the rest of pen, and be sure that all your birds have plenty of greenstuff and exercise.

Bronchitis, as a rule, comes in the cold, wet weather of autumn, but it sometimes causes trouble at other seasons if fowls be exposed to violent storms or are kept in ill-ventilated, dirty houses. It may be induced by the spreading about in yards or on floors of unslaked lime, for this irritates the bronchial tubes and lungs, and so makes the birds prone to take cold more readily than they should do.

If the disorder becomes apparent, be careful to pick out all suspects and house them separately, keeping them fairly warm, dry, and out of draughts, and give each sick bird one drop of tincture of aconite three times a day. It is but seldom they will need treating for more than four days.

Many of the reputed cases of "gapes" are really bronchitis, and whereas the treatment for the latter will not hurt birds suffering from gapes, that for gapes would be likely to kill those suffering from bronchitis. It is therefore wise first to treat for bronchitis all birds which seem ill and gape, and if at the end of three or four days they be not cured, then to proceed as for gapes. (Leaflet No. 58, Part 1.)

Feed your patients while under treatment on a warm mash mixed crumbly, but by no means sloppily, composed of three parts scalded bran, one part of cooked lean meat, and one part each of oatmeal and boiled linseed meal, with plenty of green food and grit of some kind, but give no hard food until birds are well. The food must be given to each bird by hand.

Fumigate the patients every night with a little eucalyptus oil on a hot shovel; this will make them cough, but will do them a great deal of good. It is also well, especially in obstinate cases, to place a bowl of boiling water in the hospital coop, into which has been poured from three to five drops of the eucalyptus oil. Both oil and water must be renewed three times a day.

Bumble-foot is caused in a variety of ways—by a bruise possibly from treading on a sharp stone; from a thorn or piece

of glass; by jumping down from a high perch on to a hard floor; or even, perhaps, from the bird's blood being out of order, in which case it is rather hard to cure, as, besides poulticing and lancing the foot, some tonic must be given internally or blood poisoning may ensue.

Five-toed birds, such as Dorkings, Faverolles or Houdans, are peculiarly liable to this ailment, more especially when kept in stony runs.

In any case isolate the bird, and do not let it perch, but bed it down on bruised straw (which should be changed twice a day); poultice the injured foot as often as each application gets cold with bread or linseed, and when the foot is quite soft lance it lightly and squeeze out all matter, afterwards washing the wound thoroughly but tenderly with a weak solution of carbolic acid and water; next take a soft rag and dry the foot, and paint the wound with a solution of 10 grains nitrate of silver in 1 oz. of distilled water. Bind the foot up just so tightly as to bring the cut edges together, put in two stitches, and in a few days the bird should be well.

In every case of lameness catch the bird up, wash the foot quite clean, and examine it first before treating as here advised, for if there be no sign of a wound, and the bird be either very heavy or very light, it may be the mischief is caused by liver or kidney trouble, as this ofttimes shows first by a lameness in one leg, generally the left.

Colds are not likely to develop into roup, but as they may do so it is well to treat them promptly, when, as a rule, they are quite easily cured. Do not say, as some do, "There's a chicken ill, if any more go like that we shall have to do something." Whenever a bird is ill, and whatever is the matter, take it away from the others at once, for colds are often easily spread, and much mischief may be caused by delay.

A very good preventive of colds is to put a small piece of camphor in each drinking trough, only on no account must the water be allowed to dry up, or your camphor will evaporate and your labour be wasted; and to add a little ground ginger to the soft food. If, in spite of all your care, colds do come, then proceed as follows:—Rinse out the mouth of each

sick bird with a solution of 25 grains sulphate of quinine to one fluid ounce of water. If after a couple of days in a warm sunny house or coop, out of the reach of draughts, any birds be still unwell, fumigate them at night, as for severe bronchitis, and give each one from two to three pills, according to how ill they are, composed as follows :—

Lard (fresh liquor)	1 tablespoonful.
Mustard	2 tablespoonsful.
Ground ginger	2 ,,
Cayenne	1 teaspoonful.

the whole stiffened with flour. These must be actually put down the patient's throat ; and here it will be as well to say that in all cases of feeding a bird of any kind by hand the greatest care must be taken not to double up the tongue or the bird will be choked.

The proper way to feed a bird by hand is to proceed as follows :—Take the bird out of coop, tie its legs together, and place it under your left arm, holding it tight enough to prevent struggling ; open the mouth with the first finger and thumb of left hand, holding the tongue down ; put the spoon containing the medicine right into the bird's mouth and then, when medicine has been given, withdraw spoon, close bird's mouth, and keep it closed until dose has been swallowed.

Constipation can generally be very easily cured by giving the bird a dose of from 10 to 30 grains of Epsom salts in warm water on an empty stomach, and by feeding it chiefly on cut "green" bones (these must be absolutely fresh from the butcher), bran and cabbage ; but in case of "stoppage," unless a competent veterinary surgeon can be called in at once, it is best and kindest to kill the bird promptly.

Consumption, to an ordinary person, seems much like liver disease, though there may be no connection between the two. Liver disorders come from impoverished stock and over-fattening food, whereas consumption, though sometimes coming from careless in-breeding, is generally to be traced to neglected colds or pneumonia.

Chickens hatched from anæmic stock are, moreover, prone to acquire the disease.

As there is no certain remedy known, and as the disease spreads rapidly, it will be found advisable to kill all birds so affected, and to burn the carcases.

Cramp comes, like apoplexy, from over-feeding, or from too much fatty matter; from being kept on stone or concrete floors; and, sometimes, from imperfect circulation.

The feathers "stare," especially across the back, and, though the eye may be bright and the plumage glossy, the bird has no strength in its legs at all.

Soak the legs in hot mustard and water, and, when quite warm, rub dry, and then anoint them first with turpentine and afterwards with vaseline. Repeat the treatment in a few hours' time, and the bird will generally recover.

In order, however, that the symptoms may not recur, see that all your birds have plenty of exercise; throw down some small grain among their scratching litter, and give them a large-headed cabbage or mangold to pick, and let them have more fresh lean meat than before.

Leg Weakness, which usually shows itself among over-forced young table poultry, may be treated precisely the same as cramp, but the treatment, to be truly efficacious, should be more thorough, for while the cure of cramp is only a matter of hours, if taken in time, leg weakness often cannot be stopped in less than a fortnight. Proceed as follows:—Put the affected birds quite away by themselves, and do not allow them to perch, but bed them down on peat-moss, chaff, or bruised straw; feed them chiefly on pea or bean meal, sharps, bran, a good deal of lean meat or cut green bone, and greenstuff, giving them a tablespoonful of Douglas' mixture (see p. 487) to every quart of drinking water every other day for a month. On no account let the birds have any hard corn for a couple of weeks, but feed them up on the food already mentioned. That your birds may not receive a set-back of this sort be careful not to feed over much on such foods as maize or maize-meal, rice or white bread.

Crop (Diseases of).—The bird seems to be always trying to swallow something.

Many causes conduce to crop disorders—poison, an over-liberal supply of black or red pepper, or even too much spice. As a general rule, if there is to be any hope of recovery, the bird must be fed by hand, and here, once more, attention must be called to the fact that a fowl can easily be choked during the process of hand feeding unless care be taken with its tongue.

The best remedy in case of poison is to give a teaspoonful of magnesia in hot water, and in any case the food should be principally composed of boiled bran, finely-chopped boiled cabbage, beef tea, and boiled linseed meal, for at least a week, four times a day. The bird must be fed by hand.

The fowl must have plenty of green food, but this should be cooked or inflammation may be set up.

In the case of dry grass balling in the crop an operation is sometimes needful. Take the bird on your knee, having first tied its legs together, and pour down its throat a teaspoonful of hot water; after ten minutes' rest knead the crop gently for a few minutes, say five, and continue to do so at intervals of two hours during daylight. If this does not cause the obstruction to pass lance the crop, take out everything which it contains, and then sew up the wound, being careful to sew the two skins separately, and not to let the stitches lie over one another. If fed as advised above the bird will soon recover its health.

Diarrhœa can usually be stopped by giving one meal of well-boiled white rice, strained very dry, over which a little powdered chalk has been sprinkled. In very bad cases proceed as for dysentery.

Diarrhœa with young birds often comes from unsuitable or sloppy foods, from too much heat in the foster-mother, or from filthy sleeping quarters and runs.

Dropsy, which can be brought on by damp runs, or may be the outcome of kidney disorder, affects both chicks and grown birds, and may be apparent either in the feet or all up the legs; it may even come from a touch of frost-bite. It may generally be cured by increasing the desire for exercise, and by feeding on more greenstuff, lean meat, and other non-fattening matter. A dose or two of castor oil will be advisable. Dropsy rarely makes its appearance when birds have plenty of opportunities of hunting for their food among dry litter of some sort.

Too much stress cannot be laid on the fact that light, airy quarters and scratching sheds are an absolute necessity if disease is to be prevented. This is generally only a matter of shillings, whereas deaths may run into pounds.

If abdominal dropsy occur it is usually traceable to filthy quarters and bad feeding, but in this case also is secondary to some internal disorder. The only cure is to tap the dropsical parts with a needle, previously *boiled* in water, but as birds so affected must never be used for breeding purposes it is questionable whether treatment of any kind is worth one's while.

Dysentery may be treated, so far as mild attacks are concerned, in the same way as diarrhœa, but all drinking water must be boiled.

The droppings are often frothy and may show signs of blood. Give Douglas' mixture in the drinking water, keep the bird dry, out of draughts and fairly warm, and give it one pill from the following recipe once a day. Cure is generally certain but somewhat slow :—

Powdered chalk	5 grains.
Rhubarb	4 do.
Cayenne pepper	2 do.
Opium...	½ grain.

If these pills cannot be obtained in time give from one to five drops chlorodyne, according to whether the bird be chick, fowl, or turkey.

The Douglas' mixture tonic may be continued for a month.

Egg-Bound, due to the inflammation of the egg passage, or to the accumulation of surplus fat in and around the intestines, is more common in the late winter than at any other season. If birds be provided with large, airy, sunny scratching quarters, and are fed on non-fattening rations, with a good supply of grit and oyster shell, there should be no trouble of this sort, though sometimes the disorder may be caused by the straining in passing a very large egg. If caused by internal fat the bird will usually die on its nest.

Pullets which become egg-bound at the beginning of their "lawter" generally come right of themselves, but if the hen be really over-fat cure is out of the question.

The only way of any service to pass the egg is to dip the finger in oil and to put it up the oviduct, so breaking the egg; every particle of shell must, however, be got out or inflammation will be set up. Hold the vent over boiling water, feed the bird—which must be put away from its mates—on light food, giving it only tepid water to drink, with additional greenstuff and lean meat. When putting it back into its coop, after treatment, give a dose of 15 grains of Epsom salts, and do not allow it with other birds for at least a week.

Feather-Eating is often the result of confinement and insufficient green food. Give all birds so affected some well scalded clover-hay chaff in their morning warm mash, and see that birds have a wider range, if possible, and plenty of good grit. As a matter of fact, scalded hay should be given to all kinds of poultry every day from October to the end of March, but it must be well scalded over night. Clover-hay is best, but ordinary meadow-hay will do very well.

Frost-Bite sometimes comes, especially with Minorcas, from cold north or east winds, and is not by any means confined to the winter months. Keep the affected ones in warm, dry quarters, with plenty of light and air, but out of direct sunlight; give them more greenstuff, and if the comb be very black, but only in this case, add one-half teaspoonful of muriate of ammonia to every pint of their drinking water. Their combs may be dressed with the following ointment:—

Vaseline	3 tablespoonsful.
Glycerine	2 do.
Turpentine	½ tablespoonful.

Gastritis is an enlargement of the food passage between the crop and the gizzard. Birds so affected must be fed entirely on soft food, but should have no bran or sharps, and all the meals used should be well sifted to eliminate husk. Hay-chaff boiled in skimmed milk is excellent as the staple foodstuff. Be most careful to see that the bird does not catch cold, or it will probably die, despite all your care.

Moulting, especially in bad weather, is a severe strain on the bird's constitution. Give Douglas' mixture twice a week in all the drinking water and add to the soft food, which should

be given warm, one teaspoonful of the following to every ten birds :—

Ground linseed ...	...	...	...	7½	lb.
Do. Gentian ...	...	...	...	1	lb.
Do. Coriander seed	...	...	...	2½	lb.
Do. Fenugreek	...	...	..	2½	lb.
Do. Capsicum...	...	...	...	2½	oz.

Give scalded hay-chaff, lean meat or cut green bones, charcoal, and plenty of grit, and birds will generally feather out well and quickly.

Pip, not being a disease, requires no special treatment. As, however, it is usually a sign that the birds are out of order in some way, watch your flock, find out what is the matter, and treat them accordingly.

It is as well to rub a little glycerine on the hardened tip of the tongue occasionally.

Pneumonia (inflammation of the lungs) is shown by a short, hacking cough. Remove the birds to dry, warm quarters *at once*. Be most careful to thoroughly disinfect the houses from which the birds were taken, and to burn the bedding and droppings.

Chicks with hens allowed their liberty in wet weather often die of this complaint, which more often than not is called "gapes" or "pip."

Feed the sick birds for a week on little else than beef tea or a meat extract, in which a raw egg has been whipped up, and give them this food *every two hours* for the first day. Let the birds eat if they will, but if they show no sign of wanting to do so feed them by hand, or they will die.

Give a dose of one drop of tincture of aconite in a teaspoonful of water every two hours for the first day, and if birds be very ill paint them over the lungs with iodine, afterwards gently rubbing in a little vaseline to keep the skin from cracking, and be exceedingly careful to keep the patients out of draughts.

Scaly Leg can be easily cured, but if not treated promptly will very likely infect the whole yard. Directly it makes its appearance catch up the affected birds, rub their legs with

kerosine and, when the oil has soaked in, with strong sulphur ointment, and keep the birds isolated until they are cured.

On no account rub the legs with hot water and a hard brush, as was formerly supposed to be necessary; it is a most cruel and quite useless proceeding.

In stubborn cases it is well to repeat the treatment in four days' time.

Soft Eggs are sometimes the result of fright, more often of over-stimulating food or want of lime. They are of rare occurrence where birds are given scalded clover-hay chaff with their soft food.

Add an abundance of this food to the other rations, and see that birds have plenty of oyster-shell and grit; remember that on no account must maize or wheat be fed for a time. Twice a week give a large teaspoonful of sulphate of magnesia in the drinking water to every ten birds.

Douglas' mixture, which every poultry-keeper should have in his medicine chest or near at hand, for it is the most valuable tonic known, is prepared as follows:—

½ lb. sulphate of iron (green copperas).
½ fluid oz. sulphuric acid.

The whole should be well mixed with a gallon of hot water should be well shaken before use, and must be kept in an earthenware or glass jar—for it would eat its way out of a tin in a very short time—labelled "Poison."

The usual dose is one tablespoonful of the mixture to a gallon of water, but for special use, such as in the case of "white comb," that dose may be doubled. As a rule it should not be given more often than twice a week. It is of the greatest use for young or breeding ducks during raw, wet weather.

In order that birds may be kept in the best of health, it is advisable to add 1 oz. of table salt to the hot morning food of every 100 birds.

C. E. J. WALKEY.

CIDER FACTORIES IN GERMANY.

The following account of the cider factory system in Germany, taken from Bulletin No. 71 of the Bureau of Chemistry of the United States Department of Agriculture, may be read in conjunction with the article on "Cider Factories in France," in the September number of this *Journal* (p. 160.) :—

Among German cider makers of the Taunus and Rheingau districts, to propose fermenting the must in other than good cellars would be heretical. The cellar is here the first essential. Everywhere the small proprietor and the great manufacturer work on essentially the same principles. These cellars are well built of good masonry, the walls being finished in hard mortar and the floors in cement, as though they were intended to endure for ages. Drainage, ventilation, hoists, and the like are carefully looked after.

The mills most generally in use in Germany for grinding or crushing the fruit are either single-cylinder rasping or grating mills, or two-cylinder crushers ("greif" mills). The simple grater mill serves its purpose very well, but the consensus of opinion seems to be decidedly in favour of the stone cylinder crusher. This mill, in different sizes, was found in use, some being driven by small steam or gasoline engines. In fact, small factories with good appliances and good cellars are quite common in the territory visited.

The German cider maker may have a building devoted entirely to that purpose, as the large makers invariably do, or, as in the case of farmers and other small makers, he may use only a portion of a building, the remainder being used for other purposes. The grinding and pressing rooms may be additions built on to another structure, the cellar extending under the whole. In no case was fruit seen stored in upper rooms or lofts,

but usually on the floor of the operating room or in bins adjacent. The small makers seem to make little or no provision for storage, and the grinding and pressing, so far as observed, were conducted on the ground floor. In the small plants this requires only a moderate amount of floor space, the power plant and grinder being near each other and the presses adjacent. The pulp was almost invariably allowed to stand for some hours before pressing. The Germans usually have large tubs, holding, say, 10 hectolitres (220 gallons) of fruit pulp, and into these the crushed fruit is at once placed as soon as it falls from the mill. Even the largest factory visited, having an annual output of over 500,000 gallons of cider, pursues this rather cumbersome method. In large factories this requires a great amount of floor space and seems to necessitate an enormous waste of labour, but it is thought satisfactory by the proprietors. Small plants usually grind only enough fruit to make one or two cheeses at a time, and hence proceed at a rate which, in the United States, would be considered wasteful of time.

The manner of laying up the cheese is in the main the same as in the best appointed American mills, in which cribs are still used to hold the pulp during pressing. The cheese cloth has not made headway in Germany. The cribs, usually circular, are very well made.

After maceration for a period varying from twelve to twenty-four hours, the pulp is brought to the press and submitted to as heavy pressure as possible by hand power, drop screw presses being largely used, but also those with the screw on a central stem. The pressure is applied for a considerable period until the cheese is carefully drained; then the pomace is thrown up and finely broken, and either macerated with water, as in France, or allowed to rest for a period, when it is pressed a second time in a stronger press. The Germans do not use much water in macerating pomace for re-pressing; in fact, a very small amount was used where the operations were observed. The best German factories inspected did not use water at all, but these were equipped with hydraulic as well as hand presses, and the pressing was completed at a pressure of 250 atmospheres on the hydraulic presses. The differences in sugar content of French

and German fruit have some bearing on the use of water in macerating.

The largest German factory visited, that of the Freyeisen Brothers, Frankfort, is possibly the largest in the world. Its annual output is about 25,000 hectolitres (660,000 gallons). The working equipment consists of one grinder, a large number of mash tubs in which the pulp is macerated, 22 presses (six of these hydraulic), teams, tools, &c. A staff of 160 labourers is employed. In this factory, and also in most of the smaller German factories visited, the fruit is washed before grinding, usually by dumping it into a great vat of water and elevating it from this to the grinder by a screw rotating in a half-cylinder.

The workmen carry the apples from the bins in wooden vessels resembling tubs, holding about a bushel, and dump them into the washing vat. The pulp is taken in similar vessels as it falls from the grinder and carried by the workmen to the macerating vats. From these, after maceration for about twenty-four hours, it is again filled into the tubs and carried to the presses. The pressure is applied slowly, and the pulp is allowed to drain a long time. Then the pomace is cut up fine, put into another press, and re-pressed without addition of water. The third and last pressing is accomplished at 250 atmospheres. No further use is made of the pomace. The specific gravity of the must averages about 1·050.

The methods of handling the must are now to be considered. The pressing of the pomace, as explained above, generally occurs on the ground floor immediately over the cellar. To this first cellar the fresh must is conducted through rubber pipes, either by gravity or by pumping, and is put directly into the great casks in the fermentation room.

It is the German custom not to fill the casks so full that there will be any discharge of froth or top lees through the bunghole, 6 or 8 in. of clear space being left in the top of each cask. As soon as a cask in the fermentation room is filled, it is fitted with the ventilating funnel. Nearly all good cider factories are provided with cellars at least two stories in depth, so that the room for final fermentation and storage is immediately below the first cellar.

The chief advantage of the cellar is the ease with which temperature can be controlled. For instance, in the upper cellar, by introducing air through ventilating flues, it is possible to raise or lower the temperature in accordance with the condition of the atmosphere, and once the proper temperature is reached its maintenance is fairly easy. However, in the cold season, if the temperature falls too low, resort is had to a heating apparatus. The temperature which the Germans seem to prefer for the fermentation room is 59 deg. to 65 deg. F., the lower figure being preferred if active fermentation starts promptly at this temperature. In the lower cellar or finishing room a temperature of 45 deg. to 50 deg. F. is preferred. Still lower temperatures are obtained in late autumn and winter.

The comparative ease with which the cider can be piped from one cellar room to another under this German system is very apparent. The liquor must, in the course of its progress to a finished product, pass from a warmer to a colder temperature, and this is here accomplished by gravitation. The hoist at last lifts the finished product from the lowest room to the ground floor. Naturally, the great casks are never disturbed except for purposes of repair or renovation. The finished product is either bottled direct in the storage room or transferred to smaller casks for transportation. Manholes are provided in the floors of each room to permit the passage of the pipes, &c., used in handling the product.

IMPORTS OF AGRICULTURAL PRODUCE IN 1903.

The following tables, which have been compiled from the Trade and Navigation Returns, show the quantities and values of the principal articles of agricultural produce imported into the United Kingdom during the past year compared with similar imports for 1902.

The imports of live animals show a considerable increase over the figures for 1902, mainly attributable to the large increase in the numbers received from Canada, which sent us more than double the number of cattle and over 50 per cent. more sheep. The resumption of the shipments of live animals from Argentina for three months in the spring of the year also accounts for part of the increase, but the United States show a falling off in the number both of cattle and of sheep, 22,674 fewer cattle and 61,841 fewer sheep having been received in 1903 as compared with 1902. The changes in number of the animals recorded from the countries mentioned are, however, due, on the one hand, to the closing of the New England ports consequent upon the outbreak of foot-and-mouth disease in the United States, and, on the other, to the re-admission of Argentine stock (for slaughter) into this country. The average value per head of the cattle imported in 1903 was £17 12s. 5d., and of sheep £1 10s. 10d., as against £18 12s. 7d. and £1 11s. in 1902.

The imports of fresh beef from the United States have increased since last year, but they have not yet reached the figure for 1901, and the same remark applies to Australia, while New Zealand sent us 77,427 cwt. less than in 1902. The total amount received shows an increase of 452,219 cwt., the Argentine supply being 228,463 cwt. more than in 1902. The declared value of the fresh beef imported was 40s. 3d. per cwt. in 1903 and 42s. 8d. per cwt. in 1902.

TABLE I.

Imports of Live and Dead Meat.

Description.	Quantities.		Values.	
	1902.	1903.	1902.	1903.
	No.	No.	£	£
Cattle	419,488	522,546	7,814,753	9,209,122
Sheep	293,203	354,241	454,422	546,063
Total Live Animals ...	712,691	876,787	8,269,175	9,755,185
	Cwt.	Cwt.		
Beef, Fresh	3,707,387	4,159,606	7,905,064	8,366,141
,, Salted	153,574	173,692	244,002	245,605
Mutton, Fresh	3,659,599	4,016,622	6,914,911	7,826,062
Pork	655,376	705,844	1,446,145	1,555,452
,, Salted	205,259	237,583	305,584	319,264
Bacon	5,089,704	5,156,988	13,426,967	13,619,140
Hams	1,482,287	1,141,332	3,858,902	3,142,574
Meat, Unenumerated, Salted or Fresh ...	655,023	663,261	1,199,110	1,206,152
Meat, Preserved	911,356	767,557	2,786,194	2,435,826
Rabbits (dead)	451,457	475,645	734,326	723,881
Total Dead Meat ...	16,971,022	17,498,130	38,821,205	39,440,097

There was a substantial increase in the imports of fresh mutton, New Zealand sending us 400,397 cwt., and Argentina 133,269 cwt. more than in 1902, though the receipts from Holland and Australia both show a considerable decrease. The rise in the value per cwt. of imported fresh mutton was continued, the price being 39s. as against 37s. 9d. in 1902, 36s. 7d. in 1901, 34s. 5d. in 1900, 31s. 7d. in 1899, and 29s. 7d. in 1898.

The imports of bacon remain substantially the same, though there was a slight increase, and the value per cwt. was 52s. 10d., which is 1d. more than in 1902. The decrease in the import of bacon from the United States, which was noticed in 1901 and 1902, still continues, but the receipts from Denmark and Canada have increased. Taking bacon and hams together, the proportion of the total import which is supplied from the United States has fallen from 80 per cent. in 1901 to 60 per cent. in 1903.

With the exception of preserved meat, hams are the only item in Table I. which show a decrease as compared with 1902, the

United States sending us 373,610 cwt. less than in that year, a falling off which is not counterbalanced by an increase from Canada. The value per cwt. of imported hams still continues to rise, the price being 55s. 1d. in 1903, as against 52s. 1d. in 1902, 48s. 8d. in 1901, 46s. 9½d. in 1900, and 41s. 4½d. in 1899.

The chief feature in Table II., which contains the figures for dairy produce, margarine, and eggs, is the continued rise in the imports of butter and eggs, larger quantities of both of these commodities having been received than in any previous year.

TABLE II.

Imports of Dairy Produce, Margarine and Eggs.

Description.	Quantities.		Value.	
	1902.	1903.	1902.	1903.
	Cwt.	Cwt.	£	£
Butter	3,974,933	4,060,684	20,526,690	20,798,706
Margarine	966,170	883,193	2,569,503	2,316,354
Cheese	2,546,212	2,694,214	6,412,002	7,054,305
Milk, Condensed ...	914,675	915,86	1,807,351	1,739,078
Milk and Cream, Fresh..	22,030	22,587	37,613	41,176
	Gt. Hundreds	Gt. Hundreds		
Eggs	18,966,795	19,848,897	6,308,985	6,617,619

The imports of butter show an increase of 85,751 cwt., and Denmark still remains our chief source of supply. The rise in the imports from Russia, which has been a feature of the two previous years, was not continued in 1903, 5,763 cwt. less being received from her than in 1902. Increased amounts have been received from Denmark, Sweden, France, Victoria, New South Wales, Queensland, and New Zealand, but there has been a heavy fall in the receipts from Canada, 100,301 cwt. less being received than in 1902. The total amount of butter imported from our Colonies was 554,677 cwt., being over 13 per cent. of our total import. The average value of the imports of butter was 102s. 5d., as compared with 103s. 4d. in 1902 and 104s. 3d. in 1901. There was a decrease of 82,977 cwt. in the imports of margarine, the falling off being mainly from Holland, which, however, still supplies us with 95 per cent. of our imported margarine. In cheese, Canada still maintains her lead, sending us 1,848,152 cwt., or 69 per cent. of the total importation.

There is a rise in the receipts from Holland and New Zealand, and a reduction of 29,563 cwt. in those from the United States. The rise in the average declared value of imported cheese still continues, the figure for 1903 being 52s. 4d. per cwt., as against 50s. 4d. in 1902 and 48s. 2d. in 1901.

The quantity of imported fresh milk and cream remains practically stationary, though there is an increase in value due to the larger proportion of cream. Owing to an alteration in the Customs returns it is not possible to compare the imports of milk with previous years, but the total amount received is quite insignificant.

The import of eggs continues to increase, the excess over 1902 being 882,102 great hundreds. Russia is still by far the largest exporter to us, the receipts from that country being 1,463,728 great hundreds more than in 1902. Just one-third of our total import of foreign eggs came from Russia last year, as compared with 25 per cent. in 1901. The other chief sources of supply are Denmark, Germany, Belgium, and France, in that order. It appears that the Russian eggs are mainly of an inferior quality, for, while the average declared value of the total importation was 6s. 8d. per great hundred, the average value of Russian eggs was 5s. 6d., of Danish eggs 8s. 7d., and of French eggs 8s. 4d. per great hundred.

The next table shows the imports of horses, poultry, wool, and other miscellaneous animal products :—

TABLE III.

Imports of Horses, Poultry, and Miscellaneous Animal Products.

Description.	Quantities.		Value.	
	1902.	1903.	1902.	1903.
			£	£
Horses ... ... No.	32,686	27,266	835,769	631,269
Poultry and Game £	—	—	1,059,044	1,203,086
Lard ... ... cwt.	1,650,830	1,732,715	4,118,992	3,870,849
Tallow and Stearine ,,	1,782,098	1,395,174	2,708,717	1,987,885
Wool, Sheep, Lambs lb.	637,129,733	599,509,732	19,924,255	20,622,523
Sheepskins, undressed No.	16,301,695	17,084,812	1,611,066	1,736,805
Hides* ... ... cwt.	661,198	493,781	1,595,109	1,230,743

* Does not include dry hides.

Wool again shows a decrease, 37,620,001 fewer pounds being received than in 1902, which was mainly attributable to a falling off of 45,825,153 lb. from Australia, though France also sent 11,985,314 lb. less than in 1902. To some extent these decreases were made up by an increased supply from Turkey, South America, British South Africa, British East Indies, and New Zealand. The re-exports, 285,000,000 lb., were only 800,000 lb. more than in the previous year, so that the quantity retained for home consumption was 315,000,000 lb., as compared with 354,000,000 lb. in 1902. There was a rise in the average value, the figure being 8¼d. per lb. as against 7½d. in the previous year. Imports of lard, nearly 92 per cent. of which comes from the United States, have increased, but the average value per hundredweight has declined from 49s. 11d. to 44s. 8d. Tallow and stearine again show a decline, the United States being the only country which has increased its supply. Whereas in most recent years, except 1901, the import from Australia were more than double that from the United States, in 1903 the quantities received were 300,750 cwt. from the United States and only 188,265 cwt. from Australia. The value of the imports of poultry and game again exceeded that of any previous year.

The imports of wheat and wheat flour expressed as grain amounted to 116,743,000 cwt., which is a larger amount than in any previous year, and 8,764,000 cwt. more than in 1902. There has been a considerable drop in the receipts of wheat grain from the United States, the decrease, as compared with 1902, amounting to 19,116,835 cwt., so that whereas 54 per cent. of the total importation in 1902 came from the States, in 1903 this country only accounted for 27 per cent., or just half its former proportion. Russia has increased its exports by 10,635,845 cwt., Argentina by 9,805,290 cwt., and the British East Indies by 8,216,256 cwt. Our receipts from Australia fell from 5,437,700 cwt. in 1901 and 4,174,753 cwt. in 1902 to 26 cwt. in 1903. The average value of the imported wheat grain was 6s. 10d. per hundredweight, as against 6s. 8d. in 1902 and 6s. 7d. in 1901.

The imports of barley show an increase of 1,347,241 cwt.; the supply from Russia, which now sends us 45 per cent. of the total importation, having increased by 2,061,353 cwt., while the United States and Roumania sent less than in 1902. The

average declared value of the imports of barley was 5s. 5d. per cwt., as against 5s. 2d. per cwt. in 1902.

TABLE IV.

Imports of Grain and Flour.

Description.	Quantities.		Value.	
	1902.	1903.	1902.	1903.
	Cwt.	Cwt.	£	£
Wheat	81,002,227	88,130,634	27,079,823	29,940,545
Wheat Meal and Flour	19,386,341	20,601,191	8,925,617	9,722,596
Barley	25,200,837	26,548,078	7,131,712	7,219,314
Oats	15,857,167	16,281,914	5,041,323	4,263,928
Oatmeal...	612,602	729,087	486,241	537,415
Maize	44,492,977	50,097,877	11,713,132	12,464,184
Maize Meal	242,841	590,416	83,270	176,622
Peas	2,035,110	1,829,853	740,123	690,737
Beans	2,065,593	1,765,202	703,659	594,630
Other Corn and Meal ...	1,755,570	1,824,118	539,372	576,227
Total	—	—	62,444,272	66,186,198

There was only a slight increase in the imports of oats, the quantity being still very much below that in 1900 and 1901. Russia has again increased her pre-eminence in this trade, the receipts from that country being 61 per cent. of the total. In fact, it is interesting to notice that last year Russia supplied us with nearly a third of our total importation of wheat, barley, and oats. The average value of the imported oats shows a large drop, the value being 5s. 3d. per cwt., as against 6s. 4d. in 1902

The receipts of maize from the United States have recovered from the very small amount imported in 1902, though they are still nearly 7,000,000 cwt. less than in 1901. The supply from Roumania, which was 18,591,914 cwt. in 1902, has fallen to 4,230,276 cwt., while that from Canada has increased from 104,993 cwt. in 1902 to 3,387,331 cwt. in 1903. The average value of the imported maize has declined from 5s. 3d. per cwt. in 1902 to 5s. per cwt.

The chief feature of Table V., which includes miscellaneous articles of vegetable produce, is the large increase in the imports of potatoes and apples, the quantity of the latter article being

higher than in any previous year. Notwithstanding the almost complete failure of the home crop of apples, the average value of those imported fell from 13s. 6d. per cwt. in 1902 to 12s. 2d. per cwt., while the average value of the imported potatoes re-

TABLE V.

Miscellaneous Imports of Vegetable Produce.

Description.		Quantities.		Values.	
		1902.	1903.	1902.	1903.
				£	£
Onions	bush.	7.605.489	8.619.719	999.942	1.003.026
Potatoes	cwt.	5.699.090	9,150,202	1,589.432	2.602.904
Tomatoes	,,	783.894	1,068.435	700.126	951 499
Vegetables, unenumerated	£	—	—	468,411	396.957
		Cwt.	Cwt.		
Apples	...	2,843.517	4,568,413	1,923.474	2.781.348
Pears	...	491.906	271.483	439.536	326,463
Plums	...	541,136	596.182	515,059	622.948
Cherries	...	166,359	110,192	216.421	167,142
		Bunches.	Bunches.		
Bananas	...	*2,804.700*	*3,087.516*	*1,060.263*	*1,196,887*
		Cwt.	Cwt.		
Strawberries	...	40.211	32,644	58.080	49.362
Currants	...	76.080	76,419	92.112	110,535
Gooseberries	...	27.564	34.312	16,919	28,444
Hops	...	191.324	113 998	798.586	578.739
Flax	...	1 408.400	1,894 020	2 944.390	3,675.634
Hemp	...	2,301.380	2,347.500	3.913.094	3.581.968
Clover and Grass Seeds ...	...	337,802	458,048	740,387	1,008.772
Wood and Timber (except Furniture Woods, Hardwoods, and Veneers)	...	Loads. 9,607,442	Loads. 10.108,564	23.275.256	25,137.525

mained substantially the same as in the previous year. The imports of hops fell from 191,324 cwt. to 113,998 cwt., but the average declared value rose from 83s. 6d. per cwt. to 101s. 6d. per cwt. There was a slight increase in the imports of flax, hemp, and timber (other than furniture woods, hardwoods, and veneers), but imported hemp shows a decline in average value from 34s. per cwt. to 30s. 6d. per cwt.

AGRICULTURAL AND MISCELLANEOUS NOTES.

EXPERIMENTS IN THE GROWTH OF RED CLOVER.

The very wet character of the season of 1903 in many instances prevented clover and other seeds from ripening properly, and farmers may accordingly have some difficulty in obtaining clover seed of good germinating power. Farmers purchasing such seed, particularly of foreign origin, should moreover be careful to see that it is free from dodder seeds, which may easily escape detection unless a close examination be made. It may therefore prove useful to summarise some recent experiments regarding the growth of clover from seed of varying origin.

The German Agricultural Society have recently published an account of some experiments conducted in various parts of that country with red clover seed of different nationality during 1900-2.* They were carried out under the direction of a committee at the agricultural stations of Hohenheim, Poppelsdorf (Bonn), Weihenstephan, Göttingen, Tharandt, Halle, Breslau, and Königsberg, the different conditions of Germany being thus represented. A total of 32 samples was used from the following 15 regions, viz. :—Silesia, Prussia, Palatinate (Germany) ; Baltic Provinces, Poland, Southern Russia (Russia) ; Galicia, Styria, Bohemia (Austria), Italy, Northern France, Southern France, Canada, North-East and North-West United States.

The weight of green produce was considered unsatisfactory as a test, owing to the varying degrees of moisture, &c. ; and the comparison as finally made deals with the weight of dry matter yielded on the different plots.

* Arbeiten der Deutschen Landwirtschafts-Gesellschaft, No. 83.—*Anbauversuche mit Rotklee verschiedener Herkunft.* Berlin : P. Parey, 1903.

On the average of the two years 1901 and 1902, the largest amount of dry matter was yielded by seed from the following districts, in the order named :—Silesia, Prussia, Russian Baltic, and Palatinate ; by far the smallest amount was yielded by Italy, followed by Southern and Northern France. The results are somewhat complicated by the fact that in East Prussia such red clover is called a "late clover" and usually only cut once.

The general conclusions drawn are that the home-grown (German) seed, especially the Silesian and Prussian, was superior to the others ; that it was followed by Russian and Austrian seed, between which there was not very much to choose ; whereas the French and Italian seed must be regarded as unsuitable. The American seed, drawn from a very wide area, gave variable results.

In considering the utility of these results as affecting English conditions, it will not be overlooked that the seeds which proved most suitable were precisely the native kinds, followed by varieties from adjacent countries, while the worst came from the much warmer climates of Southern France and Italy. In this connection it is therefore desirable to notice the results arrived at in the experiments conducted under the direction of Mr. A. N. M'Alpine, Botanist to the Highland and Agricultural Society of Scotland.*

The object in the case of these experiments was rather to test the monetary value of the seeds purchased. English seed is usually sold at a much higher price than other sorts, the chief factor in the price apparently being the size of the seeds, *i.e.*, the number of seeds in a pound weight. The sorts selected for comparison were American, Canadian, French, New Zealand, English, and German red clover, with American cow-grass, the price varying from 56s. in the case of American red, to 112s. for English per cwt. The experiments were carried out on three different farms. Mr. D. Wilson, of Carbeth, whose results are given in most detail, found that, if cost is not taken into consideration, New Zealand red, American cow-grass, and American red proved most useful in his soil and

* *Experiments on Red Clover Seeds*, by A. N. M'Alpine. Trans. High. and Ag. Soc., Scot. 5th Series. Vol. x., 1898, p. 224.

climate. The New Zealand red yielded slightly heavier crops in 1896, but fewer plants survived the succeeding winter. The German was decidedly less suitable for the district.

The conclusions drawn by Mr. M'Alpine were that the produce depends on the germinating power of the seed used, and on the number of pure and germinating seeds per pound, size and appearance counting for very little if the two foregoing conditions are satisfied. New Zealand red proved most suitable at Carbeth. A satisfactory basis of valuation would take into account percentage of purity and of germination and the number of seeds per pound weight. High priced seed did not yield the largest crop.

IMPORTATION OF CALIFORNIAN LADYBIRDS.

The Board have been favoured by Mr. F. Paget Norbury, of Malvern Link, with the following account of an experiment made by him last year in importing ladybirds from the United States with a view to combating the aphides in his hopyard. The consignment, which was sent over in the spring of 1903, consisted of two gallons of the Californian species, *Hippodamia convergens*, known in the United States as a ravenous devourer of plant-lice, and more especially of the Woolly aphis.

The ladybirds on arrival at Malvern were released into a small field of lucerne adjoining the hopyard. Owing, however, to delays on the journey, a large percentage were dead: Mr. Norbury reckons that not more than 1,500 had survived the journey. In spite of inclement weather the insects successfully found their way to the hopyard; and on a bright sunny day some twenty to fifty could be noticed during a casual walk through the yard.

There was last summer an unusual number of native ladybirds, but the Californian species was easily recognisable; the colouring being a far more brilliant scarlet, whereas the English were more generally of a yellowish hue. The presence of a large number of indigenous kinds naturally detracts somewhat rom the value of the experiment. The imported beetles

appeared to be fairly active in the search for food, but Mr. Norbury found that they did not, as a rule, climb to a greater height than five or six feet from the ground, and he noticed them constantly on the ground and among the clods.

They bred successfully, their larvæ being easily distinguishable by their colour and size. They were very active, and undoubtedly destroyed a large quantity of aphides.

Mr. Norbury only found it necessary to wash his hops once, although most of his neighbours washed from two to four times. He does not, however, consider this fact a good criterion, as his is a new plantation, half a mile from the nearest hopyard, and the ground was therefore probably not previously infested with vermin. Washing did not kill the ladybirds, but only knocked them off the bine temporarily.

The attack of aphis suddenly ceased towards the latter part of July, and the ladybirds were subsequently found scattered all over the farm, and as far as 600 yards from the hopyard. They were principally in amongst the mangolds, upon which they must also have laid their eggs, for a number of "colliers" (larvæ) were at one time noticed upon the leaves.

Like so many experiments of a similar nature, it is not easy to estimate with any degree of certainty the result of a single trial, owing to the difficulty of gauging climatic causes, &c., and to the other circumstances already mentioned.

Mr. Norbury is accordingly unable to say whether the result can be held to have proved a financial success. Had a larger number survived, he has no doubt that they would have more than amply repaid the outlay. It will be interesting to see whether any of the first consignment manage to survive the English winter.

MANURING OF HOPS.*

Hops, like most luxuriantly growing plants, are very responsive to nitrogenous manures; and this observation formerly led to the neglect of phosphates and potash as ingredients in manures for this crop. Of late years, however, Mr. A. D.

* *The Manuring of Hops.* By Bernard Dyer, D.Sc. (Vinton & Co. Price 1s.)

Hall, Director of the Lawes Agricultural Station, Rothamsted has shown that the hop plant requires these latter substances just as much as nitrogen; that the hop is, in fact, an all-round feeder. Hitherto, also, the nitrogenous manures applied have been mostly of an organic character, which are only slowly available, while sulphate of ammonia and nitrate of soda have been comparatively neglected; the latter, indeed, being regarded as of little value, probably because the hops were not at the same time supplied with phosphatic and potassic manures This fertiliser, however, may prove very useful as a dressing in spring, more particularly if the other nitrates have been washed out of the soil during a rainy winter; and it has been used a good deal of late years.

With the view mainly of ascertaining the limits within which nitrate can be most economically and safely used, experiments have been carried out during the past eight years on the farm of Mr. Shrivell, at Hadlow, near Tonbridge, under the supervision of Dr. Bernard Dyer. To make the experiment as simple and direct as possible, nitrate of soda was the only source of the nitrogen supplied to the plants, and was applied, in varying quantities, with phosphates and potash.

The manures applied, and the cost per acre, are shown in the following table :—

Plot.	Annual Manuring per Acre.	Annual Cost of Manure per Acre.
		£ s. d.
A	*Phosphates and Potash	2 10 0
B	Phosphates, Potash and 2 cwt. Nitrate of Soda	3 10 0
C	Phosphates, Potash and 4 cwt. Nitrate of Soda	4 10 0
D	Phosphates, Potash and 6 cwt. Nitrate of Soda	5 10 0
E	Phosphates, Potash and 8 cwt. Nitrate of Soda	6 10 0
F	Phosphates, Potash and 10 cwt. Nitrate of Soda... ...	7 10 0
X	30 loads (15 tons) London Dung	6 0 0

* 8 cwt. superphosphate and 2 cwt. muriate of potash in 1896; 10 cwt. basic slag and 2 cwt. sulphate of potash in 1897; 8 cwt. superphosphate and 1 cwt sulphate of potash in 1898; 10 cwt. basic slag and 5 cwt. kainit in 1899; 10 cwt. superphosphate and 2 cwt. sulphate of potash in 1900; 10 cwt. superphosphate and 2 cwt. sulphate of potash in 1901; 10 cwt. basic slag and 2 cwt. sulphate of potash in 1902.

The remainder of the field was dressed in certain years with various fertilisers.

The yield in each year, together with the rainfall, was as follows:—

FUGGLES HOPS, 1896-1902.

Plot.	Weight of Kiln-dried Hops per Acre.								
	1896.	1897.	1898.	1899.	1900.	1901.	1902.	Average of seven years.	1903.
	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.	Cwt.
A	13½	7½	8¼	20¼	8	19½	12¼	12¾	9½
B	16½	9¼	10¼	22¼	9¾	23¾	14½	15¼	12
C	16½	12	12½	23	11	25	15¾	16½	13
D	15¼	13	13	22¼	10½	24¼	15¼	16¼	12¾
E	15	13½	15¼	23½	11	25¾	16¼	17¼	15¼
F	15¾	13	15	24½	10½	25	15¼	17	15¼
X	13	8	9¾	24½	10¾	26¼	16	15½	13¾
	In.	In.	In.	In.	In.	In.	In.	In.	
Total Rainfall ...	24.19	23.05	18.25	24.64	26.60	20.26	21.44	22.63	—
Rainfall—Jan.-Sept.	15.72	18.12	10.73	16.89	18.80	13.26	15.60	15.59	—

In the earlier years, no critical examination was made as to the comparative quality of the hops from the several plots; but in and since 1898 they have been submitted to chemical examination and also to examination by market experts, the latter affixing a price to the samples according to what they would be worth if placed on the market at the time they were sent in. The chemist's valuation, which would tend to represent the value to the brewer, was higher than that of the merchants, who quoted a price "to the grower." The pecuniary results are shown in the next table, the merchants' valuation, as the most important to the farmer, being quoted.

On the whole, the most profitable results, from the farmers' point of view, have been produced on Plot E, *i.e.*, by 8 cwt. of nitrate of soda per acre. So large a dressing as this would not, however, be given where dung and other miscellaneous nitrogenous fertilisers are used from time to time.

Dr. Dyer quotes also the results of similar experiments conducted in 1900-2 at twenty-one hop plantations in Germany, under the auspices of the German Hop Growers' Society, in

Plot	Annual Manuring per Acre.	Valuation of Crops per Acre at Factors' Quotation.						Average annual increase in value as compared with Plot A.	Average Annual Cost of Manure per Acre.
		1898	1899	1900	1901	1902	Average Annual Value.		
		£	£	£	£	£	£	£	£ s. d.
A	Phosphates and Potash	56	35	40	38	67	47	—	2 10 0
B	Phosphates, Potash and 2 cwt. Nitrate of Soda	73	45	48	44	80	58	11	3 10 0
C	Phosphates, Potash and 4 cwt. Nitrate of Soda	89	48	52	48	86	65	18	4 10 0
D	Phosphates, Potash and 6 cwt. Nitrate of Soda	92	50	50	46	82	64	17	5 10 0
E	Phosphates, Potash and 8 cwt. Nitrate of Soda	104	59	51	48	87	70	23	6 10 0
F	Phosphates, Potash and 10 cwt. Nitrate of Soda	102	56	48	44	81	66	19	7 10 0
X	30 loads (15 tons) London Dung ...	69	47	54	49	84	61	14	6 0 0

which the best results (according to weight of produce) were attained with 5¼ cwt. nitrate of soda—the highest quantity used—accompanied by phosphates and potash.

As to the practical limits of safety, Dr. Dyer and Mr. Shrivell conclude that, even when the soil is otherwise liberally manured by autumn or winter dressings of dung, rape dust, fish guano, &c., 4 cwt. of nitrate per acre, applied early in the season, may be regarded as a thoroughly safe dressing for hops. This quantity should not be exceeded in the case of the more delicate varieties. *If no other nitrogenous manure has been* given, as much as 8 cwt. may be used.

Large quantities of nitrate should be divided into separate applications of not more than 2 cwt. per acre, at an interval of some weeks. April and May are the best time to use it.

INFLUENCE OF CHANGE OF SEED ON THE YIELD OF POTATOES.

The Yorkshire College, Leeds, in a "Report on Tests of Varieties of Potatoes in 1902 and 1903" (Bulletin No. 35), draw attention to the influence of change of seed upon the yield. It has generally been recognised that the introduction of seed from another district gives a better crop than seed of the same variety grown on the same farm for a few years. An instance of this was noted at Garforth last year, where the yield from seed of certain varieties originally obtained three years previously from another locality, was compared with seed obtained from the same grower in the spring of 1903. The resulting crops showed a marked increase in favour of the new seed in each case :—

Total Yield of Potatoes per acre.

Variety.	Old Seed.			New Seed.		
	Tons.	Cwt.	Qrs.	Tons.	Cwt.	Qrs.
British Queen	11	16	0	13	12	2
Challenge	9	0	3	13	10	0
Conquest	8	19	0	11	17	2
Eightyfold...	7	0	0	11	12	2

It should also be pointed out that the old seed had the advantage of having been selected in the previous autumn, and that when planted the sprouts were longer than those of the new seed.

There was no disease among the tubers from the new seed, whereas disease was present in all those from the old seed, in amount varying from 14 to 33 per cent. of the crop.

FIXATION OF ATMOSPHERIC NITROGEN BY CHEMICAL AGENCY.

It has long been anticipated that a means would, sooner or later, be devised whereby the free nitrogen of the atmosphere would be brought into some form of chemical combination that would make it available as manure. This is actually accomplished by natural agencies through the action of the bacteria associated with the roots of the Leguminosæ, but such fixation of nitrogen, important as it is in the economy of the

farm, does not lend itself to industrial conditions. It has also long been known that nitrogen may be induced to unite with oxygen through the agency of electricity, but, so far, this process is hardly beyond the stage of a laboratory experiment. Recently attention has been given to fixation through the agency of calcium carbide, and a description of the process, with an account of experiments conducted with the resultant substance on various crop-plants, were communicated on the 18th of February to the Manurial Section of the German Agricultural Society by Prof. Gerlach, of Posen.

The nitrogen so fixed may be used either as calcium cyanamid or as ammonium sulphate. The experimental results in some cases are very favourable to the new substance, while in others they are less so. Evidently there is still much to learn with regard to the conditions under which it may be most advantageously employed, but there can be little doubt that the report in question marks a long step forward.

[Mitt. Deut. Land, Gesell. Feb. 20th, 1904.]

THE MUSSEL SCALE.

(*Mytilaspis pomorum.* Bouché.)

The Mussel Scale (*Mytilaspis pomorum*), or Oyster-shell Bark Louse, as it is sometimes called, is found chiefly on apple, but also on pear, currant, plum, hawthorn and blackthorn. This

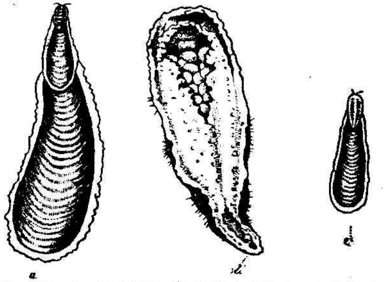

Fig. *a*, Female Mussel Scale, dorsal view; Fig. *b*, ventral view; Fig. *c*, Male Scale.*

*** From *First Report on Economic Zoology*, British Museum, National History Department.**

pest, one of the most injurious British scale insects, is also found in North America, Australia, New Zealand, and South Africa, having been imported on nursery stock. In this latter way it is also largely distributed in this country. The necessity of fumigating young stock before planting is thus rendered essential and should be done by all nurserymen before their stock is sent out. A few scales may easily escape detection and so set up a large colony, to the detriment and even death of the tree. There is no district in England where this pest does not occur in greater or less abundance. Old trees and neglected orchards chiefly encourage it, but young stock suffer far more than old.

This scale insect is frequently taken for growths on the bark; but the scale is the product of a minute insect belonging to the *Coccidæ*. The male and female scales differ in appearance and size; the former being seldom observed.

The insect damages the trees by sucking out the sap with a long, flexible mouth, which it inserts into the plant tissues. It occurs not only on the trunk and boughs, but also on the leaf and fruit. Foreign apples are frequently imported covered with this and other scale pests. The scale, as in all *Coccidæ*, is a product formed by the insect which lives beneath it, partly by excretions from its body, partly by the cast skins of the insect, the so-called exuviæ.

Life History.

The female scale (Fig. *a*, *b*) is about one-eighth of an inch long. It is rounded at the end, but tapers to a point at the head; it may be straight or curved, and even much contorted. In colour it varies from deep brown to almost grey. The male scale is much smaller than the female and of the form shown in Fig. *c*.

The eggs are laid by the sedentary female under the scale. They resemble to the naked eye small whitish dust. As many as eighty may be counted under a single scale, but the number varies considerably. The eggs give rise in the early summer to very small, active six-legged larvæ, which crawl from beneath the scales and may be distributed from tree to tree by the wind, by birds, and by predatory insects, such as lady-birds. They are about one-hundredth of an inch long.

In a short time they fix themselves to the plant by their short proboscis and draw away the sap; the scale then commences to form by the excretion of a few waxy threads and gradually grows to the form shown in Fig. *a*. During this period the larva loses its legs and becomes converted into a fleshy legless creature; the female remains feeding beneath the scale and is

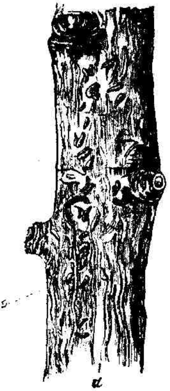

Fig. *d*, Piece of branch infested with Mussel Scale.

provided with a long flexible proboscis, which is inserted into the tissues of the plant. Towards the end of the summer she deposits her eggs and dies, her shrivelled skin remaining beneath the scale.

If the larva is going to become a male, not only is a different scale produced (most often upon the leaves) but a totally different mature insect. The male undergoes a kind of pupal stage and escapes from the scale as a small winged insect. The males are very rare, most of the females reproducing asexually. A single brood normally exists in this country.

Scales have many natural enemies, but this species and those that attack the currant in this country are not materially lessened by them. Amongst the natural enemies birds alone do any good. The *Paridae* or tits and a few other birds, such as the tree-creeper and wryneck, feed upon this scale. Lady-

birds and their larvæ eat scale, but none seem very partial to the mussel scale in Great Britain. Minute hymenoptera (*Chalcididae*) also live as parasites upon them, but seldom do any appreciable good.

Treatment.

The only sound advice that can be given to fruit growers is to go on washing and ignore the infinitesimal help given by these minute parasites, also to encourage those useful birds, the tits, in orchard and garden. The trunks, &c., of all trees must be kept clean, *i.e.*, free from rough bark, moss and lichens. This can be done by washing in winter with caustic alkali wash (see Leaflet 70), which at the same time corrodes and loosens the scales from the trees. Badly infested trees should also be sprayed in the early summer—about the middle of June—with paraffin emulsion, two or three times, at intervals of a few days. This kills numbers of the young and corrodes away to some extent any remaining scales. Whitewashing the trunks of the trees as far as the forks of the boughs does some good and helps to keep the wood in a healthy state. All young stock should be treated in order to destroy the scale, before or soon after being planted. The best method is fumigation with hydrocyanic acid gas, the most valuable scale remedy.

The bushes or young trees should be placed in a box or canvas tent of known capacity and subjected to the fumes of hydrocyanic acid gas for one hour. Large numbers can be treated at once at little expense. After the stock is stacked under the tent or in the box a jar should be placed on the floor, and then water placed in it. Sulphuric acid is added to the water, and then the cyanide of potassium, wrapped in blotting paper, dropped into the acid and water.

The proportions are as follows :—¼ oz. of cyanide of potassium, 1 oz. of sulphuric acid, 1¾ oz. of water for 250 cubic feet of space.

This can, of course, be reduced according to the size of the fumigating box or tent.

It must be remembered that the gas is deadly poisonous to man, and that the cyanide of potassium is also a deadly poison. The fumes must not be breathed. The cyanide should be in small lumps, wrapped in blotting paper, and then dropped into

the acid and water, and the box or tent rapidly closed. When opened at the end of an hour, it should be done so that the wind blows the fumes away from the operator, and left to ventilate for half an hour before the stock is removed

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PLUM APHIS.

(*Aphis pruni*, Reaum).

This is one of the most destructive plum pests, and was unusually abundant in 190[illegible], complaints being received from all parts of the country. The attack is very characteristic; the leaves shrivel up, the edges being gradually rolled up and forming nests for the rapidly increasing insects; the fruitlets soon commence to fall, and the leaves die right off. During last season it was observed that the young leaves that were attacked fell prematurely when still green, but as a rule they hang on, and the tree presents a strikingly characteristic appearance.

Damson plantations often suffer most severely from this blight. A good show of blossom may be seen in May, and by June scarcely a fruitlet or leaf will be seen on the trees. Plums of all kinds and greengages suffer nearly as severely. The same aphis may also be seen on peach, apricot, apple, and, according to Buckton, on the aster. It is subject to considerable variation in size and colour, and probably occurs on other plants, amongst which have been mentioned chrysanthemum and gooseberry. Wild prunes, such as the sloe, afford a constant means of invasion of our plantations.

This species must not be confused with the hop-damson aphis (*Phorodon humuli* var. *Malaheb*), easily distinguished by the frontal tubercles, which are absent in the plum aphis.

Life History.

The aphis first makes its appearance in the early spring, when small green lice may be observed here and there on the young leaves. These have come from eggs that have remained all the winter upon the plum trees. These lice rapidly grow into the wingless viviparous females, large green aphides, varying in hue to olive brown; they have three faint green stripes on the

abdomen, olive brown antennæ, and brown cornicles; the whole body above and below is covered with a mealy down. These apterous females soon commence to produce living young, which rapidly mature and produce other young. This asexual repro-production of wingless forms goes on for some time, and under favourable conditions to such an extent that the leaves, which have gradually curled up, die off. As food supply commences to fail these lice, instead of turning to wingless viviparous females, enter a pupal stage, rudiments of wings—"wing-buds"—appearing. The pupa is shining green and dull yellowish, the wing-cases tipped with dark brown; the green cornicles also tipped with black. The pupal form has been observed in the first week in June, and again in July. Sometimes all the lice on a tree enter this stage at once, at other times only a few.

The winged female coming from the pupa is also viviparous—in colour she is apple green, with black head, thorax, and antennæ; on the green abdomen is a dark patch and dark lateral spots; the wings are irridescent with brown veins. These winged viviparous females fly about and settle upon other trees, thus setting up fresh colonies. Their living young grow into apterous viviparous females, which carry on rapid reproduction like the first series.

In the autumn the pupal stage is assumed again, but from the pupæ now come winged males and wingless oviparous females.

The winged male is small, with a dusky ochreous body and a dark brown head, markings on the thorax, and three on the abdomen. The colour varies considerably, some males being almost black and some wholly black, according to Buckton.

The apterous oviparous female is pale yellowish-green, almost transparent, with brown cornicles. This female, after being fertilised by the male, deposits little shiny black eggs at the base of the buds and on the twigs. Egg-laying may commence early in October, and goes on until November. These eggs usually hatch early in April, but the lice have been observed as early as March. Not only are the eggs laid on prunes, but also on the apple, and probably on peach and nectarine. They are firmly attached by a gummy excretion by the parent, and are too thick-shelled to be affected by caustic alkali wash.

Another green aphis, *Hyalopterus pruni* (Fabr.), also infests plums, swarming under the leaves and producing white hoary masses, which, however, do not seem to curl up the leaves in the characteristic way done by *Aphis pruni*. Apterous viviparous female of this aphis is flat, pale green, with dark green mottlings, a dark dorsal stripe, and dusted with white meal ; the winged viviparous female is a bright pale yellowish-green, with red eyes and dark green thoracic lobes ; cornicles green and very small ; legs pale green, and wings with yellow base and stigma. The oviparous female lays her eggs near a leaf-bud, the egg being covered with a mealy coat. It may frequently be found doing damage, but not nearly to the same extent as the former species.

Methods of Prevention.

This pest can easily be kept in hand if attacked in its early stages. When once the females commence that remarkable and rapid production of living young and the leaves begin to curl up, they are difficult to destroy. Not only do the curled leaves protect them, but they are also covered with mealy powder, which helps to keep off the insecticide. Washing should begin as soon as the leaves unfold, and must be continued every now and then, at intervals, say, of a week. Some good will be done by spraying even when the leaves are curled up, but not much ; to be successful the lice must be killed before they enter the breeding stage. Quassia and soft soap or paraffin emulsion may be used for this purpose.

THE DOT MOTH

(*Mamestra persicariae.* Linn.)

Dot moth caterpillars are frequently recorded as pests. Their food plants suffer much : as a rule garden flowers, such as dahlias, marguerites, marigolds, pansies, geums, &c., suffer most ; but vegetables, fruit trees and bushes are also eaten by these larvæ. They have also been recorded on lilac, poplar, clematis, ivy, &c. They are ravenous feeders, and strip the plants in a very short time.

The moth appears in June and July. It varies from an inch

and a-half to an inch and three-quarters in size. The front wings are blackish, with a dull purplish gloss when fresh; there are rusty brown marks, and also small pale spots at the tip and hindmost edge. These spots may, however, be indistinct, and a large white kidney-shaped dot may be very pronounced. The hind wings are dusky grey, shading into dull whitish at the base. The moths fly at night, and deposit their eggs upon the food plants, as many as thirty being laid by each female.

The larvæ appear from the beginning of July until the latter part of August, those hatched latest not maturing until the end of September. When full grown they are about an inch and a-half long. Some have been found as late as the middle of October. The larva varies in colour from deep green to pale green or grey, or even reddish-grey, the colour being apparently influenced by the food plant. Owing to this variation of colour they are often very difficult to detect when feeding. The caterpillars have a pale dorsal line, and some darker marks along the back; there are five dark oblique bands below; the head is green, and the thoracic shield has two dark green or brown patches. The colour seems to vary not only with the plant, but with the part of the plant attacked, and Buckle figures four larvæ on *Pteris aquilina*, green caterpillars being on green parts, and brown on the brown parts.

When full grown the larva falls to the ground and changes into a brown pupa in the earth, remaining in that condition until the following summer.

The best remedy in gardens is hand-picking. Where the caterpillars appear in large numbers on gooseberry and fruit bushes, it would be best to spray with some arsenical wash. It is said that if they are shaken off the plants, and drenched when on the ground with cold water (especially in hot weather), violent purging is caused and the caterpillars are reduced to mere skins (Ormerod).

Gardens that have been attacked by the Dot moth should be lightly forked over so as to expose the pupæ to the attacks of birds. It would be worth while to let ducks, or in an orchard fowls, run over the infested ground: both ducks and fowls devour the pupæ greedily.

APTERA ON CAULIFLOWERS AND CELERY.

The Board recently received from Pembrokeshire specimens of insects which were destroying the roots of cauliflowers and celery. These insects were identified by the Natural History Museum as belonging to a genus of *Aptera* known as *Lipura*. These insects frequently swarm in the ground, especially in cucumber frames or hot beds, but they attack the roots of almost all plants. Carrots may frequently be found covered with them, particularly those suffering from "rust," and celery also is severely injured, the attack being worst when other insects have mined the outer bleached stalks.

Lipura and *Collembola* (another genus of *Aptera*) feed upon the plants where the tissue is sound just as much as where the plants are diseased. Little is known regarding the life history of *Lipura*, but it breeds in the soil and the young form resembles the adult.

These insects are always most abundant in damp soil and in wet seasons. Soot and lime worked into the soil with a prong-hoe has been found beneficial in attacks of this and allied species of *Aptera*. If they are doing harm in only a small area, it would be worth while to inject bisulphide of carbon into the ground where cauliflowers are growing and along the rows of celery. For cauliflowers an ounce to every four square yards, and for celery half an ounce every three yards, alternately on each side of the rows, is the best quantity, care being taken to put it about six inches away from the plants and under the sloping earth, so that it will descend down to the roots. Care must be taken not to let the liquid bisulphide touch the roots of any plants, and it must be remembered that this substance is both poisonous and highly inflammable.

LARVÆ OF TORTRICID MOTHS.

The larvæ of several tortricid moths do much harm to fruit trees. All these pests can easily be destroyed by arsenical spraying; but by about the middle of June the larvæ are all full fed, and it would not then be worth while to spray them.

The trees should be washed with caustic alkali wash in winter, and with arsenate of lead and paraffin emulsion in early spring. The latter wash should also be applied when the leaves are out, and again after the blossom has fallen. Recent observations show that arsenate of lead is more effective than Paris green for destroying all mandibulate fruit pests.

LONG-HORNED LOCUST.

Specimens of a "long-horned locust" (a species of *Diestrammena*) were recently found to be damaging the spikes of Hippeastrums in a nursery at Richmond, and another specimen was recently found in a cellar in London. The natural home of this insect is China and Japan, and the insects which were found at Richmond were no doubt brought over with consignments of lily bulbs from Japan. As both male and female mature insects were present in the nursery, and as this locust has now been found in two different localities, there seems to be a possibility that it might breed here under favourable conditions, though probably not in the open air.

DRY ROT.

(*Merulius lacrymans*, Fries.)

As a destroyer of timber used in the construction of dwelling-houses, the fungus popularly known as "dry rot" has been too well known for many years. Notwithstanding modern improvements in ventilation, &c., the disease appears to be gradually gaining ground, owing mainly to the following causes: (1) The use of immature and imperfectly seasoned wood; (2) the rapidity with which modern houses are built, resulting in the imprisonment of too much moisture in the material used.

Infection with the dry rot fungus sometimes takes place in the forest, when felled timber remains stored there for some time. The first evidence of such infection is indicated by the presence of red stripes in the sawn wood. If such wood is thoroughly seasoned the mycelium present in the red stripes, is killed. If this precaution is neglected, or imperfectly done

the mycelium, which possesses the power of remaining in a latent condition for some time, commences active growth when the wood is used in any part of a building where it is exposed to dampness; and this in some cases is unavoidable, as when the ends of joists are built into a wall. Under such circumstances dry rot eventually appears.

On the other hand, the fungus is by no means rare on old beams and boards stored in wood-yards, &c., and it is mainly from such sources that spores or portions of the spreading mycelium are introduced along with new wood into buildings.

Again, when repairs are being made to a house that has suffered from dry rot, sufficient care is not exercised in the instant destruction by burning of diseased wood; and portions that are not too much decayed are often stored for repairing purposes. By such means the air in towns always contains spores of the dry rot fungus.

During the building of a house the danger arising from the presence of dry rot may be reduced to a minimum if proper precautions are taken.

A thorough system of ventilation and the avoidance of damp, stuffy places is of primary importance. The endeavour to exclude dry rot by hermetically closing all communication with the outer air in the spaces between flooring-boards and joists, and similar places, has been practically demonstrated to be an utter failure, and one entailing a cost of many thousands of pounds to rectify in the case of a mansion constructed during recent years.

Perhaps the greatest source of danger arises where the ends of joists are built into a wall near the basement of a house, and this is more especially true where there is evidence of red stripe in the wood. As a precaution, the ends of joists should be treated with creosote. Coal tar is not recommended, as its power of penetration into the wood is very limited and by forming a waterproof coating it prevents the wood from drying.

Another frequent source of danger arises from the use of damp deadening material, or "pugging," and covering it over with boards before all the moisture has evaporated. Such material should be used as dry as possible, coarse sand being the best for the purpose. The surface of boards coming in

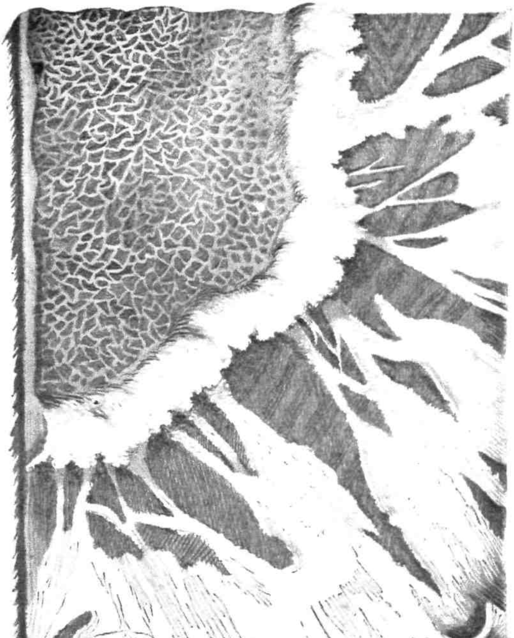
contact with deadening material should first be painted over with methylated spirit containing corrosive sublimate in solution —six ounces to one gallon. The spirit evaporates, leaving a coating of corrosive sublimate on the boards, which completely destroys any mycelium coming in contact with it.

It has been proved that the spores of dry rot can only germinate in moisture containing some alkali in solution, hence coal-dust, cinders, or any kind of humus should never be used for deadening or packing.

The fruit of the dry rot fungus presents the appearance of irregularly shaped, flattened or undulating patches of variable size, adhering by their entire under surface to the substance on which they are growing. When mature the central portion of the patch is covered with an irregular network formed by slightly raised anastomosing ribs, and is of a rich brown colour, due to the enormous quantity of spores, which are deposited on surrounding objects under the form of snuff-coloured powder. These spores are diffused by currents of air, rats, mice, insects, &c.

The margin of the fruiting patch is surrounded by a snow-white fringe of mycelium, which spreads in every direction over surrounding objects, creeping up walls and passing through crevices, the advancing mycelium being supplied with food and moisture from the parent plant growing on wood. This food is conducted through cord-like strands which form behind the thin advancing margin of mycelium.

Owing to this supply of food from a central source, the mycelium can extend over stones and other substances not containing food, and thus spread from the basement to the top of a house. Each time the migrating mycelium comes in contact with wood, the latter is attacked, and a new centre of food-supply is established from which strands spread in search of other sources of food. The mycelium often forms felt-like sheets of large size that can readily be removed intact. These sheets are at first white, but soon change to a pale grey colour, a character by which dry rot can be readily distinguished from another wood-destroying fungus, *Polyporus fomentarius*, even in the absence of fruit, the felted mycelium of the latter remaining permanently white.



"DRY ROT," showing the fruiting portion; also the white spreading felt-like mycelium.

The spreading mycelium can be checked by the application of carbolic acid, and when its presence is once detected, all wood-work that can be reached should be thoroughly saturated with the same substance.

The specific name of *lacrymans*, or "weeping," alludes to the power of the fungus to attract moisture from the atmosphere. Under certain conditions moisture is absorbed to such an extent that it hangs in drops, or even drips from the surface of the fungus. This moisture assists very materially in rotting the timber, which afterwards becomes quite dry and friable. Hence the popular name "dry rot," which alludes to the last, and most frequently observed, stage of decay.

DISEASED LILACS.

Specimens of diseased lilac branches which were forwarded to the Royal Botanic Gardens, Kew, last summer, were found to have been injured by a fungus, *Botrytis cinerea*, Pers. This generally first shows itself in the fork of a branch, and thence extends so that the branches often present a rusted and girdled appearance. The portion above the wound usually dies in the second season after the attack.

The leaves of the lilacs had also been scorched by frost. Such injury is not as a rule of a serious nature; but last season, owing to the excess of rain, some of the injured leaves were attacked by the *Botrytis*, and the fungus in some instances ran down the injured leaf, attacking the stem.

Where lilac branches are injured by this fungus, they should be cut away below the wound and burned at once. Where the wound is only slight, and confined to only one side of the branch, painting the diseased portion with fir tree oil might prove beneficial.

By using smudge fires during the night, when late frosts are expected, lilacs would be secured from harm. Damp sawdust, into which a small quantity of gas-tar is stirred, is cheap and effective. The fires should be made on the windward side of the trees, and about 200 yards apart.

LOCKING OF MILK CHURNS FOR CARRIAGE BY RAIL.

The Board of Agriculture and Fisheries continue to receive representations as to the alleged loss of milk, in course of transport by railway companies, from the cans or churns after they have left the farm. They accordingly think it desirable again to call the attention of farmers to the possibility of locking or sealing their milk-churns before delivery to the railway company.

In this connection reference may be made to the correspondence between the Board of Agriculture, the Board of Trade, and the Railway Companies' Association, in 1899, which was published in the *Journal* for March, 1900 (Vol. VI., p. 476).

In consequence of complaints then received, the Board drew the attention of the Railway Companies' Association to the hardships arising by reason of the prosecution of milk producers, in cases in which milk is proved to have been pure when handed over to a railway company for conveyance to the consignee, but is found upon arrival at the station of destination to have been adulterated. It was also alleged that the railway companies would not accept milk-churns for carriage at the "reduced" rate if they were padlocked or sealed. In their replies the Association informed the Board that the companies do not object to the churns being locked or sealed provided that the tare weight of the cans is stamped upon the outside, so that in case of doubt the quantity of milk within the churn can be approximately ascertained by allowing 10¼ lb. for each gallon of milk declared. The companies, however, reserve the right to open locked cans when there is any reasonable doubt as to the accuracy of the consignment.

The Association also stated that all the principal railway companies do not make any difference in the charges when sealed cans are used.

EPIZOOTIC LYMPHANGITIS OF THE HORSE.

A contagious disease of horses, known as "Epizootic Lymphangitis," is reported to have been recently detected in England and in Ireland.

The *symptoms of this disease are swelling of one of the limbs*, usually a hind one, and the formation on the swollen member of small nodules, which burst and discharge matter. In this respect the disease closely resembles ordinary farcy, from which, however, it may be distinguished by microscopic examination of the matter discharged from the sores, or by testing the horse with mallein.

The disease being of a very contagious character, it is *important* that it should be detected at an early stage, and the Board of Agriculture and Fisheries have, therefore, called the attention of local authorities to the danger which exists in this connection.

Every horse with a chronic "thick leg" on which sores are present should be suspected of being affected either with "Epizootic Lymphangitis" or with farcy. Horse owners would be well advised to keep a special outlook for the development of such symptoms in the case of horses recently acquired by them, and the Board would be glad to receive early information as to the existence or suspected existence of the disease in any locality.

HIDE SALT AND WIREWORMS.

The Board of Agriculture and Fisheries think that it may prove useful to give publicity to the following correspondence between the Secretary of the Board and Mr. S. Rosbotham, one of their Agricultural Correspondents, upon the use of hide salt as a remedy against wireworms. Hide salt, like fish salt, contains a considerable quantity of nitrogen, and it is possible that the good effects of the salt on the crop may be the reason that it is credited with insecticidal properties. It would be interesting to see experiments carried out with it by some of the Agricultural Colleges :—

"Board of Agriculture and Fisheries,

"4th March, 1904.

"DEAR MR. ROSBOTHAM,—With reference to the conversation

which took place between us when I was in Lancashire last week upon the subject of wireworms, I should be very much obliged if you would look through the enclosed leaflet* and tell me whether any suggestions occur to you respecting it. Your own practical experience would be of value to us.

"If at any time you thought it would be useful that we should give publicity to the fact that a leaflet on the subject has been prepared and issued, and will be supplied to all to whom it may be useful, we should be very glad to make arrangements accordingly.

"Yours sincerely,

(*Signed*) "T. H. ELLIOTT."

"Stanley Farm,

"Bickerstaffe, Ormskirk,

"March 5th, 1904.

"DEAR SIR THOMAS,—Your letter to hand this morning, and with further reference to our conversation with respect to the pest of wireworm, I can speak from experience that hide *salt applied to land in the autumn before being ploughed*, especially ley land, is an efficient remedy for wireworm. The result may not prove entirely satisfactory from the first application, and in such cases a repetition of the dressing should be made annually, until the pest is got rid of. The dressing should not exceed 3 cwt. per statute acre. No land could have been more infested with wireworm than that which I occupy at the present time. Repeated applications of hide salt have been the means of combating the pest, and to-day the farm is practically free from wireworm. As to the paragraph in the leaflet with regard to seaweed being a preventive, I might point out that the latter contains a large percentage of salt, and therefore proves that salt is a remedy for the destruction of the wireworm. Particular attention must be drawn to the fact that hide salt, and not common salt, is recommended. I think that if a paragraph could be embodied in the present leaflet, and circulated, it would be a wise and beneficial arrangement.

"I remain, etc.,

(*Signed*) "S. T. ROSBOTHAM."

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*Leaflet No. 10. Wireworms.

QUARTER EVIL, OR BLACK LEG.

Although quarter ill has existed in Great Britain and in Ireland for a very great number of years, no reliable estimate can be formed of the number of animals which annually die of this disease; but it may at least be concluded that the mortality is very serious.

Quarter ill may be said to lack much of the importance and interest which is attached to anthrax, inasmuch as it is confined to two domestic animals—sheep and cattle—and is *not communicable to man.* It, however, resembles anthrax, in so far as they are both caused by the introduction into the blood of the healthy animal of specific bacilli.

Both of these diseases have a tendency to recur on farms or premises where animals affected with these diseases have been previously kept.

On the other hand, neither anthrax nor quarter ill is communicable by association of the affected with the healthy animal, and in that respect they differ from most of the contagious diseases which are legislated for in this country.

Another peculiar feature of quarter ill is that while it is very fatal to sheep at any age, cattle over two years may be said to have an immunity against the disease.

The symptoms of quarter ill in young cattle are so strikingly different from any other disease, that an error in diagnosis is almost impossible. The first indication of an animal being affected with quarter ill is a marked stiffness or lameness of one of the limbs, usually upon one of the hind quarters; it is exceedingly dull, and presents a most anxious and dejected appearance, does not feed, and it is with extreme difficulty that it can be forced to move. Very soon after the limb is attacked a swelling appears beneath the skin, which is extremely hot, increases in size rapidly, and is most painful to the animal when touched. This swelling has a disposition to extend down the leg, or perhaps along the loins and back, and when pressed gives a peculiar crackling sensation to the fingers. In almost every instance death supervenes within a few hours after the swelling has appeared.

In the case of sheep the symptoms are not of so marked a

character. The first indication is lameness, but the swelling is not so observable in sheep as in cattle, being hidden to a great extent in the case of the former by the fleece.

There is no doubt that the disease exists to a greater extent among sheep in certain counties in England than has been generally known, and from the rapidity with which sheep frequently die it is often locally called "strike."

Should any doubt exist in the mind of an owner as to whether his sheep have died from quarter ill, the difficulty can easily be solved by making an incision through the skin of one of the dead animals into the tumour or swelling, when he will find it contains a large quantity of dark coloured fluid, which emits a very strong and peculiarly offensive odour. Any fluid that may thus escape should be carefully collected and destroyed. The organism causing the disease, like that of anthrax, is believed to exist in the soil; it has not yet, however, been determined how it finds its way into the system of the affected animals, but the probabilities are that it is through the digestive system.

No form of medical treatment has been discovered which can be relied upon as a cure for quarter evil, but it has been claimed by veterinarians residing on the Continent of Europe and in America, in which countries the disease appears to be more prevalent than it is in Great Britain, that certain vaccines which have been prepared from the organism of quarter evil give protection to the animals inoculated. Some of the authorities regard one vaccination sufficient, while others advocate two, after an interval of eight days, but the length of period for which immunity can thus be obtained has not yet been satisfactorily determined. Another most important fact, which must not be overlooked, is that sometimes the inoculation is followed by the death of the animal which it was intended to protect.

Since quarter ill and anthrax are both due to specific bacilli which, although different in form, have equally fatal results, similar steps in the mode of disinfection should be adopted. There is little hope that any attempt to destroy the spores of the disease in the soil can be followed by any good result, but measures of a preventive nature can be adopted by everyone who has the misfortune to have the disease in his sheds, yards, or other enclosed places.

The carcases of animals which have died of quarter ill should be buried in accordance with the rules laid down for anthrax, or, still better, cremated on or in the place where the animal died.

All dung, fodder, litter, or other materials of a like character which may have been on or about places or sheds where animals have died should be burnt, or thoroughly mixed with some powerful disinfectant and buried in a part of the premises to which cattle and sheep do not have access. The sheds, particularly the flooring and mangers, should be thoroughly washed and scrubbed with a 5 per cent. solution of carbolic acid, and it would be prudent to repeat the process before they are again used for cattle or sheep.*

CALF REARING.

In an article contributed to the *Weekly Live Stock Report* (Chicago), of 11th September, 1903, Mr. George Prentice gives the details of the procedure followed on his farm in Fifeshire of allowing his cows to suckle several calves.

The herd was started, in the east of Scotland, in 1888, by the purchase of thirty Dutch (Holstein) yearling heifers, which were put to a pure Shorthorn bull. In the following year they were allowed to suckle their own calves, and again crossed with a Shorthorn bull. In 1890 fifteen were sold in calf as milch cows, the intention being to introduce a certain number of newly-imported yearlings each year; but the closing of the British ports to the introduction of live stock (except for slaughter) prevented this. The Dutch cow, or a cross of it, being a heavy milker and of a tractable disposition, is well suited for rearing calves on the plan adopted in this herd, which is as follows:—

The heifers with their *first* calves are allowed to suckle them for four months, when these are taken away from their mothers

* Copies of this article in leaflet form may be obtained free of charge and post free on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W.

and another young calf is given to each, which in turn is taken away six weeks before the heifers are again due to calve. Each of the cows, on having her second calf, is given another, so that each cow has to suckle two calves at the same time. These, like the heifer's calves, are taken from the cows at four months, and each cow is given other two young calves, which are removed in time to let the cow rest and pick up before calving again. This system is carried on each year, so that each heifer with her first calf brings up two, and each cow brings up four, calves per annum. The calves required to make up the number are purchased from cow dealers at about a week old.

The cows are kept in byres, tied by the neck, from October till May, and are hand-fed on turnips, oat-straw, and a little home-grown grain or other bulky good food. When a cow is due to calve, a young calf is purchased, and as soon as she has calved it is put up beside her, and her own calf is put at the wall behind her, and out of her sight. At first the calves are put to the cow four times a day, and, after about fourteen days, only three times a day, and are taught to suckle both from one side, the cow's own calf being nearest her head. She is generally quite satisfied if she sees and can lick her own calf when suckling, and does not often notice or object to the strange calf, especially when she is tied.

After about three weeks or a month, according to the state of weather, the cow and her two calves are put into a loose box, all untied. If the cow shows much preference for her own calf, and the stranger is not getting its share of the milk, the calves are fastened together by two straps round the neck, joined by a chain two feet long. The cow's own calf must thus take the other calf with it when it goes to drink, and in almost every case this arrangement is completely satisfactory. After a time two cows and their four calves are put into a larger box, and so on till a number of them are going together, and ready to go to the fields in the spring whenever there is sufficient grass for them.

The cows are served as soon as they come in season, and the bulls are allowed to run with them when at grass, as the great aim is to get them all calved before April, so that the first lot of calves may be weaned and a new lot put on by the end of

July. If all goes well, ten calves are purchased about the middle of July, and five cows have their calves weaned.

The weaned calves are put in some covered and enclosed place, out of hearing of the cows, which are tied up again in the byre, and to each is given two of the young purchased calves These calves are kept in a loose box at the end of the byre, and are taught always to go to the same cow. After a week or ten days it is only necessary to open the door between the byre and the calves' place, when each pair of calves go to their own respective cow. After the cows have forgotten their first calves (in about eight days), they are turned out to grass, and are brought in morning, noon and night, to suckle their second lot of calves. The rest of the cows are treated in the same way, till all have a second lot of calves suckling. Of course, a calf is lost now and then, and, if it is one of the second lot, it may be too late to replace, so that the number may be thus short of two for each heifer and four for each cow; but, taking the season 1902, the result was that, with two heifers and sixteen cows, sixty-four calves were weaned, and one died after it was six months old. The calves, after they have forgotten their foster-mothers, are put on a clean foggage field (one where a hay crop has been taken) and are given 1¼ lb. of linseed cake. During the next winter the cake is continued, with an allowance of turnips and meadow hay.

Four yearling heifers are selected from the young stock and are added to the breeding stock each year; but as it is essential for the success of the plan described that the cows should be good-tempered, drafts of young and old are made from the breeding herds each year, and only those that have proved themselves to be good mothers and willing to take their proper number of calves are retained. Up to 1895 the heifers only reared one calf and the cows three per annum. At present there are in the herd two of the original Dutch cows purchased in 1888, at this date sixteen years old, having reared, up to the end of 1902, one of them forty-two and the other forty, calves in fifteen years.

The calves when weaned and supplied with generous food for some time after do not fall off at all, but improve regularly until ready for the fat market. In proof of this, the fat animals

in 1903 were sold from the herd described when from twenty-two to twenty-six months old, at an average of £15 for the heifers and £18 for the steers.

As the cows of this herd were showing signs of getting rather too long in the leg, an Angus bull has been used for the last two years with the most satisfactory results. In breeding, one must always be on the look-out to check any tendency towards exaggeration of any of the points of an animal.

There is no doubt that this plan of calf rearing, as described, entails a considerable amount of anxiety and worry, owing to the great detail in the management, especially during the calving season and while the calves are very young. The owner of this herd confesses that more than once at these seasons he has been tempted to give up his system, but when the time came for disposing of the stock, he has always found himself amply repaid for all his trouble by the prices he has got for his fat stock, and the saving of heavy outlay in the purchase of feeding stock.

WINTER EGG PRODUCTION.

If eggs could always be produced in winter, poultry-keeping would, under almost all circumstances, be profitable. This branch of the industry requires particular attention on the part of poultry-keepers. In summer, fowls, however much neglected, will lay a certain number of eggs, but in winter the number produced is in direct proportion to the skill and foresight exercised in the management of the birds.

Farmers should pay more attention to the production of eggs when prices are most remunerative. To do this it is essential that the work should be taken up in earnest, and that all efforts should be directed towards the one object in view, *i.e.*, the production of eggs regularly from October to March. This involves much trouble, and in order to ensure success the details must be studied and strictly attended to. The majority

of hens, as they are now managed, lay most eggs when the prices are lowest. It is necessary, therefore, to keep fowls that are good winter layers, and as a general rule it will be found that for this purpose birds belonging to one of the general purpose or sittings breeds, or their crosses, will give the best results. The number of eggs laid during the summer is comparatively unimportant, provided a large number are produced during the winter. It should not be forgotten that excessive egg production in summer entails a greatly reduced supply in winter.

The cost of feeding a hen for one year should not exceed 5s., or an average of little more than 1d. per week, even when all food has to be purchased. On many farms this figure could be reduced. All laying hens, when well managed, should produce at least 150 eggs in a year. If the market requirements are considered, and the eggs sold to the best advantage, a yearly profit of 5s. per hen should be obtained. Many, if not the majority of hens, do not lay 150 eggs in a year, and are kept at a loss. These are maintained and bred from, simply because the average poultry-keeper fails to distinguish between profitable and unprofitable birds.

Select a good laying breed or first cross suitable to the soil and situation. General purpose breeds are usually good winter layers. Their natural instinct induces them to become broody in the spring and summer, and the rest then obtained materially aids the production of eggs at a later season. Consequently it is unwise to entirely prevent broodiness in hens that are required to lay in winter.

Breed, however, is not everything; strain is, perhaps, more important. There are good and bad laying strains of every breed, and it would not be difficult to find birds belonging to breeds held least in repute as layers, which produce far more eggs than other fowls belonging to the most popular laying varieties. It is essential then to select birds from only the best laying strains.

Hatch pullets which will commence laying in November. For heavy breeds, which mature slowly, February and March are the best months for hatching. The light breeds, which are more active and come more quickly to maturity, may be hatched

in March, April, and May. Pullets of good laying strains commence to lay when from six to seven months old, and, as already indicated, all birds should begin to lay in November. If they begin earlier they will probably moult, which causes them to cease laying until the following spring, whereas, if birds do not start until November, they generally continue laying through the winter. If, however, pullets be unduly forced and commence laying before they reach maturity, they will always produce small eggs.

Depend mainly upon young birds, as these are the most prolific. No hens should be kept for laying after they are two and a half years old. To secure a succession of pullets hatch a number sufficient to renew half the stock annually.

A warm, well ventilated, weather-proof house is absolutely essential. It should be placed in a sheltered position on dry ground where the greatest amount of sunshine can be obtained. Dampness is fatal to success. If hens are allowed to run on cold wet ground, the number of eggs laid will be considerably reduced.

To obtain the best results, it is necessary that from November to March shelter should be provided for the fowls on wet, cold, and stormy days. This can be done most thoroughly by adopting the scratching shed system, which requires the provision of a fairly large shed attached to the roosting house. The shed is open in the front, which is covered up with wire netting, and boarded up two feet from the bottom. Here the hens are confined when the weather is unfavourable. Nothing causes them to stop laying more quickly than cold winds and dampness.

When the scratching shed system is adopted, everything possible should be done to induce the birds to scratch and keep themselves occupied all day long, otherwise the benefits of the system will be entirely lost. The shed should be littered to a good depth with short straw, which can be shaken up daily and the excrement removed from it. Some corn should be buried in the straw and the fowls made to search for every grain. A cabbage or turnip may be hung up for the fowls to peck at. This should be placed just within their reach, and will provide a certain amount of exercise and diversion. On fine days the

fowls should be allowed out on a larger run, but only when the weather is favourable.

On some farms a barn or out-building could be utilised for the purposes of a scratching shed, or for a house and shed combined; but on the majority of holdings in Ireland, such a building would not be available, and the owner might not be convinced of the advisability of erecting special sheds and houses.

Under such circumstances the fowls will have complete liberty as at other seasons of the year; but if they are satisfactorily housed at night and proper attention paid to feeding, they may still produce a fair number of eggs during the winter, provided the weather is not exceptionally bad. Still better results might be expected if the fowls could be induced to remain during the day in the driest places, and if some simple and inexpensive shelter were provided for them.

The hens should be fed liberally on food suited to the production of eggs. Overfeeding must be carefully avoided.

Indian meal should be used only in strictly limited quantities, especially if the fowls are kept closely confined.

Early in the morning a feed of soft mash, composed of ground oats or barley meal, with pollard or sharps, mixed with skim milk or hot water, should be given. Cooked vegetables of any description, or table scraps, can be added with advantage. The mixture should be given warm. In the evening give a feed of wheat or oats, for which, in cold weather, barley or Indian corn may be substituted. If the hens are kept in a scratching shed, reduce the morning feed of mash and afterwards give a portion of grain, allowing a full feed of corn as usual in the evening. The grain should be thrown into the scratching shed and not outside on the ground. A supply of green food, such as cabbages, is absolutely necessary; mangolds and turnips may also be provided, and they will be eaten with great relish by the birds. A moderate allowance of cooked flesh, given every other day, is excellent, but not often available. Freshly crushed bone, at the rate of half an ounce per bird per day, is a good substitute.

Grit—such as broken flint—clean water, and a dust bath, must also be provided.

Keep no male bird with the laying stock; the hens will lay equally well, and it is far better to have infertile eggs, as they keep fresh much longer.

Nests should be kept supplied with clean materials. Clean eggs are more easily saleable and do not so readily become stale. Moreover, if eggs are washed the bloom of freshness is lost.

Fresh eggs are damaged if kept warm for even a very short time; consequently, broody hens should not be allowed to remain on the nests.

Eggs should in all cases be collected twice daily, and stored in a cool place.

Rapid marketing is essential if quality is to be maintained. Therefore, never hold eggs over with a view to securing higher prices.

When dealing with large quantities, eggs should be graded as large, medium, and small, before being sold. Retain the small eggs for home consumption.

Find out the hens that lay small eggs, and discard them from the breeding pens.

Winter egg production is one of the most profitable branches of the poultry-keeping industry. Eggs can, without very great difficulty, be produced in the winter months if special attention is paid to the hatching of birds at the proper season, and to the details of housing, feeding, and general management. If these details are ignored, success will not be attained.*

TRANSPORT OF EGGS.

The following suggestions with regard to the packing and transport of eggs have been extracted from a circular issued by the Department of Agriculture and Technical Instruction for Ireland, and published in the third annual general Report of the Department, 1902-3.

* Reprint of a leaflet (No. 31) issued by the Department of Agriculture and Technical Instruction for Ireland.

In the interest of the Irish egg trade it is most important that the produce should be placed on the markets in the best possible condition, and the Department, therefore, invite special attention to the following suggestions :—

1. Fresh eggs should be kept in a dry, cool place, free from any odour which would be capable of impairing their flavour.

The practice which is reported to be largely followed of holding over eggs for an increase in market prices is to be deprecated, as eggs if long kept usually become stale and unsound.

2. The eggs placed in each case should be fresh and clean, and, as far as practicable, uniform in size.

3. The layers of eggs in each case should be formed with great care, and no egg the shell of which is in any way broken should be allowed to remain in the case.

4. Eggs should not, in any circumstances, be packed under rain.

5. Packing should be so carried out as to afford sufficient protection to all the eggs placed in the case.

6. New oaten straw and specially prepared wood-wool (fibre), if thoroughly clean and dry, and free from any objectionable, odour, are suitable substances for use in packing eggs for transport. If wood-wool be used a layer of clean, dry straw might, in addition, be placed on the bottom and top of the case to assist in preventing injury from concussion.

Considerable quantities of eggs brought from various countries in Europe are packed in wood-wool, and large numbers of eggs from Canada arrive in cases containing layers or compartments formed of strong paper, in each of which compartments an egg is held in position.

7. The boards and other wooden parts forming the cases should be substantial, and securely and neatly put together.

In view of the increasing competition in the egg trade especially in Great Britain, owing, in large measure, to the good condition in which foreign eggs are placed on the markets, it is of great importance that there should be uniformity in the construction and dimensions of the cases used for the conveyance of Irish eggs. From inquiries made in Great Britain and elsewhere, it is considered that the cases should

be limited to those suitable only for consignments of twelve hundred and six hundred eggs respectively. The use of such cases would greatly facilitate the handling and transit of the traffic, and would lessen the chances of breakage. Larger cases than these cannot be recommended. The dimensions and scantlings of the cases should be as follows:—

For twelve hundred eggs, each case to be made with a centre division of two parts of the same dimensions as the ends, so that the case may be sawn asunder and the consignment divided by the consignee.

Length 80 in., width 24 in., depth 10 in.; namely:—

2 ends, each 24 in. by 10 in. by 1 in.

2 sides, each 80 in. by 10 in. by $\frac{3}{8}$ in.

Top, 3 pieces, each 80 in. by 8 in. by $\frac{3}{8}$ in.

Bottom, 3 pieces, each 80 in. by 8 in. by $\frac{3}{8}$ in.

It may be necessary to increase the length to 82 ins., to admit of the division.

For six hundred eggs the dimensions would be:—

Length 42 in., width 24 in., depth 10 in., namely:—

2 ends, each 24 in. by 10 in. by 1 in.

2 sides, each 42 in. by 10 in. by $\frac{3}{8}$ in.

Top, 3 pieces, each 42 in. by 8 in. by $\frac{3}{8}$ in.

Bottom, 3 pieces, each 42 in. by 8 in. by $\frac{3}{8}$ in.

with a single partition in the centre $\frac{3}{8}$ in. thick.

For small eggs it may be deemed desirable to reduce the sizes of the cases to the following dimensions:—

For twelve hundred eggs:—

Length 76 in., width 22 in., depth 9 in.

For six hundred eggs:—

Length 40 in., width 22 in., depth 9 in.

8. The cases should be so constructed as not to leave any aperture which would admit of injury to, or extraction of, the eggs.

9. It is an advantage to have slits at the lower parts of the sides close to each end, or to have some other suitable arrangement made in order to facilitate the lifting of the cases.

10. The use of unnecessarily large and cumbrous boxes should be discouraged as a means of conveying eggs to market.

11. When eggs are being conveyed to the railway stations or to the steamships, the cases should be most carefully handled, and should be adequately protected from adverse conditions of weather. Due care should be exercised when cases are being loaded on, or unloaded from, carts, to avoid, as far as possible, up-ending the cases. They should not be placed on their sides or ends, but should be moved, as far as practicable, in a level position with the lids uppermost, and not be dragged along the ground.

REARING AND FATTENING OF TURKEYS.

In some parts of Ireland turkeys are reared in considerable numbers, and with a fair amount of success, but the best results are seldom obtained, because, through ignorance or indifference, many important factors are totally disregarded. During the first few weeks of their existence, turkeys are naturally delicate, and require particular attention. Considerable numbers die from weakness soon after they are hatched. Many more, owing to their delicate constitutions, fall a prey to "gapes," the attacks of which they are unable to withstand. These facts show the necessity for special care until the birds are two or three months old; afterwards they are quite as hardy as chickens.

Undoubtedly the chief losses in turkey-rearing are caused by breeding from immature or from closely-related stock-birds; weakly birds are the result, and this practice, being fatal to success, should be abandoned.

Turkey pullets should never be mated with turkey cockerels, or the progeny are likely to be very delicate; but two or three year old hens may be mated with well-grown cockerels, or a two or three year old male bird may be mated with early hatched pullets. Still, many experienced breeders prefer not to breed from either pullets or cockerels until they are two years old. It is not advisable to retain the birds for stock purposes after the third season unless they are specially valuable.

Size is the most important point to observe in producing birds for market. But along with great weight it is necessary that the birds should have a good deep breast and a long straight keel. Birds are required with as much flesh as possible on the breast, and without an unduly large proportion of offal.

The stock birds should be typical in shape, the males of large size and well developed, and the hens medium in size, weighing from 14 to 18 lb., but coming from a strain of large birds. Hens of large size do not usually breed satisfactorily. Under no circumstances should related birds or immature or unhealthy stock be mated. Fresh males from reliable strains ought to be introduced at least every second year. From eight to twelve hens may be allowed to each male. The stock birds should be kept in a lean active condition and not allowed to become too fat. Activeness is a sure sign of perfect health.

Turkeys should be hatched as early as possible, in order to have them well grown for the Christmas market. The value of turkeys, per pound dead weight, increases proportionately with the size of the birds. The object, therefore, in rearing turkeys for market purposes, should be to produce heavy birds of a suitable type and to have them as well finished as possible.

In order to successfully rear turkeys, a dry soil and shelter from cold east winds are essential. It is a mistake to attempt to rear them on tainted ground, or on the same land year after year; nor should they be reared together in large numbers unless very extensive grass runs are available.

Turkeys are more often hatched and brooded by natural than by artificial methods, and the former system is generally to be recommended. The young birds require very careful brooding for the first few weeks, and this can best be obtained from a natural mother.

The general treatment required for young turkeys is very similar to that for chickens, except that for the first few days closer attention must be paid to them. For twenty-four hours after hatching they require no food. During the following four days, hard-boiled eggs and bread crumbs may be given, for which, after the second day, oatmeal, barley meal, or biscuit meal mixed with sweet milk may be partly substituted. Boiled

rice is a useful addition to the diet and prevents diarrhœa. The young turkeys must be fed very frequently during this period.

At the end of a fortnight grain may gradually be introduced into the diet. Small wheat is very suitable, but should be given in limited quantities. Mixed mash, consisting of ground oats, barley meal, wheat meal, and pollards, should, however, be the chief food until the birds are three or four months old. Skimmed or separated milk is better than water for mixing the meals. No food, especially during the first few weeks, should be given in a very wet or sloppy condition, as this causes diarrhœa in young birds.

Turkeys require more flesh as food than do chickens. Boiled fresh meat or liver, finely chopped, is most suitable. From the first week turkeys should receive an abundance of green food, such as cabbage, boiled onions, or boiled young nettles, chopped up fine and mixed with the meals.

There is great danger in allowing the birds to run about amongst long wet grass or in heavy rains until they are five or six weeks old. It is best to keep them confined in a limited grass run for the first four weeks, the grass being kept short, and if the run becomes foul, to move the birds on to fresh grass. Large roomy coops are suitable for housing, but these should have wooden floors ; the coops also give shelter on wet days. In addition to the coops one or two extra shelters should be provided. When the young turkeys are given their liberty, the mother, if a turkey hen, will take them away to the fields, and they then thrive remarkably well, chiefly because of the new ground and the abundance of insect food obtained. All through the summer and until fattening commences, the turkeys should be fed in the fields and encouraged to stay there. Any airy, well-ventilated house should be provided for them. They should be fed liberally with soft foods, consisting of a mixture of meals and boiled vegetables or roots in the morning and a feed of hard corn at night.

A constant supply of grit is even more necessary for turkeys than for fowls. It should be given during all periods of growth, commencing with fine chicken grit, and later supplied in some coarser form. The importance of this item cannot be over-estimated.

About five weeks before they are to be killed, if it is thought desirable to house the birds, an outhouse, with a partially open front to the south or west, should be chosen for the purpose, but the birds must be kept clean and provided with fresh water and pure grit. The perches should be placed at a height of not more than three feet from the floor. Better results will be obtained if turkeys are kept confined to the house during this period. When, however, a suitable house is not available the birds may be allowed their liberty and given as much food as they will consume. For finishing purposes, the most suitable foods are finely-ground oats, wheat meal or barley meal, with an addition of a little Indian meal and cooked potatoes. This mixture should, if possible, be prepared with skim, separated, or butter-milk instead of water, and must be given while warm. The birds should be allowed to eat as much as they will take in the morning, and the food left over then removed. Wheat, oats, barley, or Indian corn may be given for the afternoon feed. With such feeding the birds will increase rapidly in weight and the quality of the flesh will be good.*

FRUIT GROWING AND HORTICULTURE IN HUNGARY.

The Board have received from Mr. Andrew Gyorgy, the Hungarian Consul-General in this country, a translation, which he has been good enough to make for them, of a Report by the late Hungarian Minister of Agriculture on the progress of agriculture in Hungary in recent years. The Report also contains an interesting account of the efforts made by the Department of Agriculture to encourage and extend fruit growing and horticulture, for which almost all parts of the country are well adapted.

Enquiry having been made as to the different varieties of fruit trees best suited to the soil and climate of the country, State

* Reprint of a leaflet (No. 32) issued by the Department of Agriculture and Technical Instruction for Ireland.

seedling farms and model orchards were established to raise and propagate trees, and to provide seedlings and grafting stems. These were then distributed free, or sold at low prices to small farmers, clergymen, and schoolmasters all over the country. In 1901, twenty-five such State nurseries had been established, and they distributed in that year 297,507 grafting stems and 1,429,500 seedlings. Besides improving the quality and increasing the quantity of the fruit trees, these orchards serve a useful purpose as schools of instruction for the young men who work there and obtain a practical education in fruit growing and marketing.

A very important part in the general scheme is played by the parochial orchards, under the control of the schoolmasters, who supplement in their respective localities the work done at the State nurseries. They receive free grants of trees, grafts and seedlings from the State orchards, and prizes are distributed among the schoolmasters by the Hungarian Mortgage Credit Co-operative Society.

These parochial orchards were established by Act of Parliament in 1894, along highways and roads; and in 1897 a set of model bye-laws were drawn up as a guide to the various local authorities. In 1897 a survey was made of all the main highways, and, after enquiry as to the best kind of trees for each district, free grants of trees were made by the State nurseries to be planted on these highways. At the present time there are on the main highways 101,000 fruit trees, 94 per cent. of which are in good condition. Under the Act above referred to, the duty of providing seedlings for planting on the county and parish roads is thrown on the parish orchards, but at present they have not been able to do much in this direction.

The railway companies co-operate in the work by carrying fruit trees, grafts, and seedlings for distribution at about half the ordinary rates.

In order to improve the quality of the plums grown in the country, the Department of Agriculture in 1900 bought 600,000 one-year-old Myrabolan and St. Julien plum seedlings from the orchards at Orleans and Angers, and distributed them among the State orchards.

Side by side with these efforts it has been the aim of the Department to train up a class of expert gardeners and horticultural labourers who could enter the service of the State or the larger private landowners, and to disseminate a knowledge of horticultural science among the people generally.

In 1894 the Viticultural Institute of Budapest was transformed into a Horticultural College, with a three years' course of instruction for young men, who, after four years' training in a secondary school, had worked for two years on a model horticultural farm. At the end of the three years' course the students pass a final examination in all branches of horticulture. There are usually about thirty students at the College, attached to which is a model orchard of about ninety acres.

In 1897 there was established a one year's course for young gardeners who had had three years' practical experience in horticulture. There are very many men of this class in the country, who, owing to their ignorance of the theory and science of the subject, are often unable to obtain employment. A primary course of practical instruction for horticultural labourers was established in 1895 and is now carried on at four different centres. In addition to horticulture, they are instructed in bee-keeping, basket making, and wood carving, and they readily obtain situations, as there is a great demand for their work.

In addition, there are several other colleges and schools, especially training colleges for schoolmasters, where instruction in horticulture is given, lectures are arranged for the people in their neighbourhood, and model orchards or gardens are maintained.

Short courses of instruction, lasting about ten days, are frequently arranged for schoolmasters and clergymen, and these have been so largely attended that, at the present time, there is probably at least one schoolmaster in each of the 419 administrative districts of the country who has some practical knowledge of horticulture.

In order to disseminate a knowledge of horticulture among the people generally, the Department of Agriculture publishes a weekly paper called the *Fruit Gardener*, which has a circulation of 14,000 copies. In addition, 30,000 copies of a pamphlet,

entitled *Let us Grow Fruit*, have been distributed throughout the country.

Up to the present time the Department has mainly confined its attention to efforts to improve the cultivation of fruit, but something has also been done to instruct the growers as to the most profitable methods of marketing their produce. Growers have been encouraged to exhibit at local and international shows, co-operative fruit marketing societies have been established, and grants are given to assist basket-making for the transport of fruit. The Hungarian Consuls abroad are directed to furnish periodical reports on the fruit trade of Russia, Germany, Great Britain, and Scandinavia, and the Department is thus enabled to advise the growers concerning the most profitable markets for their produce. Assistance is also given by a reduction in the railway rates for fruit and vegetables, and a pamphlet with information as to the best methods of packing fruit has been issued. The Department of Commerce has established courses of instruction in basket-making, and the Department of Agriculture has started plantations to grow the raw material; parishes are encouraged by grants to start basket-making industries, which give employment to the agricultural labourers in the winter. Forty-one plantations of willows have been established, and the number of plants has been increased by more than fifteen millions in the last six years.

The Department also assists the dried fruit industry and cider making, by leasing the necessary machines to parishes, associations, and co-operative societies, and in certain special cases gives them free. Last year two large fruit and jam factories were established with the aid of grants from the Departments of Agriculture and Commerce.

NEW ZEALAND FROZEN MEAT TRADE.

The Board have received a copy of a Report by the "Extension of Commerce Committee" of the New Zealand House of Representatives on the frozen meat trade of the Colony.

The Committee considered the following questions:—

(*a*) Whether New Zealand is in a position to increase her

output; (*b*) Whether the prices now obtained yield a satisfactory return to the New Zealand grower; (*c*) Whether there is sufficiently healthy competition for stock to keep prices up to reasonable values, or whether those dealing in New Zealand mutton and lamb obtain an undue profit.

In their Report the Committee state that the evidence shows:—(*a*) That the New Zealand flocks have been very heavily drawn upon, and that an increased output in the near future is improbable. (*b*) That the prices obtained by the growers may be regarded as satisfactory. (*c*) That the competition within the Colony of the methods of sale abroad are such as will secure a reasonable profit to the sheep growers.

The Report also contains a short review of the history of the New Zealand frozen lamb and mutton export trade, from which it appears that the total export has grown from 2,000 carcases in 1882 to 4,636,537 carcases in 1903, and that the value of the exported frozen meat for the year ended 31st March, 1903, amounted to £3,229,636, which is only £124,364 less than the value of the wool exported in the year ended 31st December, 1902. The growth of the trade since its inception in 1882 has therefore, been very remarkable. Beginning in 1882 with flocks amounting to some 12 million sheep, nearly 41 million carcases have since been exported, while the permanent stock of the country has been increased by seven millions. During the same period sheep scab, which was at one time very prevalent, has been entirely eradicated, and the rabbit pest has been materially checked.

Since the import of frozen meat into the United Kingdom began, it appears that out of 83,801,000 carcases imported, New Zealand has contributed 40,732,000 carcases, or nearly one-half; while 30,072,000, came from Argentina and 12,997,000 from Australia.

Regarding the proposals which had been been made that retail shops should be opened by the Government in large towns in the United Kingdom for the sale of New Zealand meat, the Committee report that they could not recommend proposals that might seriously interfere with trade methods These methods, notwithstanding shortcomings and mistakes have resulted in fairly satisfactory prices being returned to the

sheep growers of the Colony, and the Committee recognise that the competition of other countries is inevitable. Notwithstanding the increased production of her rivals, New Zealand has more than held her own, both in price and quantity, and the Committee were not prepared to support the proposals referred to without some better evidence that they were likely to do more good than harm.

VISITORS AT THE ROYAL BOTANIC GARDENS, KEW, IN 1903.

The total number of visitors to the Royal Botanic Gardens, Kew, in 1903 was 1,352,548—a figure which, notwithstanding the unfavourable weather, closely approximates to the average for the ten preceding years, viz., 1,352,425. The exceptional character of the weather is reflected in the great fluctuations in the monthly attendance and in the fact that the smallest day's attendance occurred on June 19th, a circumstance probably without parallel in the history of the Gardens. Of the total number of visitors, 783,822 came on week-days, and 568,726 on Sundays. The largest day's attendance was on Whit-Monday, when 73,566 persons visited the Gardens; while the largest Sunday attendance was 32,128, on May 24th. The number of visitors in each month of the year was as follows:—

Month.	Attendance.	Month.	Attendance.
January	18,638	July	164,319
February... ...	37,903	August	265,148
March	75,024	September ...	145,586
April	168,884	October	42,838
May	152,322	November ...	45,047
June	219,823	December ...	17,016

IMPORTATION OF CATTLE INTO THE TRANSVAAL.

The Board have received from the Colonial Office a copy of a return, dated July 23rd last, showing the number of cattle introduced by the Government of the Transvaal into that Colony. The work of introducing the stock has been under-

taken by three departments, viz., the Repatriation, Land, and Agricultural Departments.

The following table shows the number of cattle imported from each country by the Repatriation Department, together with the average cost per head to import. All the animals were of local breed :—

Country of Origin.	Number.	Average Cost.
		£ s. d.
Madagascar	13,140	10 15 1
Somaliland	995	6 0 11
India	90	13 10 0
Argentina	35	18 0 10
Texas	5,000	15 10 0
Bechuanaland...	3,735	16 0 3
Basutoland	462	18 10 0
Natal	2,230	16 12 8
Cape Colony	51,725	16 3 7
Total	77,412	

The Land Department ordered 5,500* cattle from Texas and 247 from Queensland. The average cost of these Texas cattle was £18 2s. They were of the following breeds :—Local breed, 4,500 ; Shorthorn, 250 ; Hereford, 275 ; Devon, 275 ; and Holstein, 200. From Queensland the consignment was made up of equal numbers of Shorthorn, Hereford, and Ayrshire breeds, at an average cost of £25.

The Land Department introduced 157 cattle from the United Kingdom, at an average cost of £47 per head, consisting of 30 Herefords, 13 Shorthorns, 24 Lincoln Reds, 24 Sussex, 18 Red Polls, 18 Jerseys, 18 Aberdeen Angus, and 12 Ayrshires.

Raiffeisen Banks in Ireland.

The Congested Districts Board for Ireland state in their twelfth annual report that there were, at the end of March last, 63 Raiffeisen agricultural banks registered in their districts, and 100 in the non-congested portion of Ireland. The Board raised the amount set aside for loans to these banks

from £3,000 to £4,500, feeling that the results of the operations of the banks justified this action. In making the loans to the banks, the Board are in every case guided by the recommendations of the Irish Agricultural Organisation Society, whose officers make all the arrangements for their establishment and inspect them periodically.

Testing of Seed Corn.

The attention of the Board has been called to the low germinating power of grain intended for ordinary seed purposes in Aberdeenshire. In most cases a germination of 50 per cent. has not been reached. It would therefore be well for farmers to test their spring corn before sowing it, in order that they may properly regulate the amount of seed to be allowed per acre.

Dairy Exhibition at Brussels.

An International Dairy Exhibition will be held at Brussels on April 23rd and 24th next, under the auspices of the National Dairy Society of Belgium. The exhibition will include dairy products in general, machinery, apparatus, educational material, &c. There will be no public trials of machinery, but special prizes will be awarded for pasteurising plant and for essays on various subjects relating to dairy economics. Applications to take part in the exhibition must be sent before April 1st, with a remittance of 10 francs as entrance fee, to M. Collard-Bovy, Secrétaire-général de la Société Nationale de Laiterie, Square Marie Louise 56, Brussels.

HARVEST AND CROP REPORTS.

THE RUSSIAN HARVEST IN 1903.

The Central Statistical Committee of the Ministry of the Interior have recently issued the following estimate of the production of the chief cereals, and of potatoes and hay, in the 72 Governments of Russia in 1903, together with the quantity of land under cultivation in each case. The corresponding figures for 1902 are added for comparison :—

Crop.	Area.		Production.	
	1902.	1903.	1902.	1903.
	Acres.	Acres.	Qrs.	Qrs.
Winter Rye	72,397,000	73,206,000	105,544,000	104,045 000
Spring Rye...	1,543,000	1,762,000	1,637,000	2,306,000
Winter Wheat	14,637,000	15,162,000	27,518,000	25,035,000
Spring Wheat	40,480,000	42,210,000	48 367,000	52,611,000
Oats...	43,173,000	43,856,000	92,777,000	79,726,000
Barley	21,701,000	23,117,000	40,553,000	42,858,000
Maize	3,363 000	3,338,000	5,564 000	5,919,000
Peas...	2,623,000	2,689,000	3,470,000	2,945,000
			Tons.	Tons.
Potatoes	9 826,000	9,977,000	1,740,000	1,552,000
Hay...	93,581,000	93,384,000	53,713 000	50,175,000

WHEAT CROP OF INDIA.

The first general memorandum on the wheat crop of the season 1903-4 states that the reports from the chief wheat-growing provinces were all favourable. In the Punjab the district estimate showed an area of 7,789,000 acres under wheat,

or 9 per cent. more than in the previous year. In the Central Provinces there was an increase of 10 per cent., in Berar of 35 per cent., and in Sind of 28 per cent. In Bombay there was also an improvement, but the information was still incomplete. The prospects were still dependent upon the winter rainfall; if adequate showers fell a good crop was expected in all the provinces except in parts of Bombay, where damage was reported from locusts and want of moisture.

CROP PROSPECTS IN FRANCE.

An official report on the condition of the autum-sown cereal crops in France was published in the *Journal Officiel* of the 6th ultimo.

The acreage under wheat, mixed corn, rye, barley, and oats is given for each department, and the following numerical method is adopted to indicate the condition of the crops; the figure 100 denotes "very good"; 80, "good"; 60, "fairly good"; 50, "passable"; 30, "mediocre"; and 20, "bad."

The annexed table gives the number of departments grouped on the above scale according to the condition of the crop:—

Index No.	Wheat.	Mixed Corn.	Rye.	Oats.	Barley.
100	1	1	1	1	1
99 *to* 80	44	40	50	29	34
79 *to* 60	38	29	35	36	25
59 *to* 50	2	0	0	1	0
49 *to* 30	1	0	0	0	0

Mixed corn was not sown in sixteen departments, barley in twenty-six, and oats in nineteen departments.

OFFICIAL PUBLICATIONS.

Board of Agriculture and Fisheries.—Produce of Crops in each County in Great Britain in 1903. Price 3d.

This publication, which is issued in advance of the Annual Volume of Agricultural Statistics, contains the complete details of the produce and yield per acre of the principal crops in Great Britain, and in order to give a comprehensive statement of the results of the harvest for the whole of the United Kingdom, a summary of the corresponding particulars for Ireland is included.

The tables are prefaced by an introductory memorandum summarising some of the more striking features of the statistics of the year's crops, and in this the caution given last year against treating the quantitative results—which alone can be expressed in these estimates—as a complete representation of the year's harvest is repeated with additional emphasis. The detailed reports received from the local Estimators contain, it is stated, ample evidence that the serious effects of the wet weather which characterised the season of 1903 were fully recognised when they made their estimates of yield. It appears that if the time of ingathering had been favourable the yield of all farm crops might have been generally satisfactory. As one Estimator expresses it, the crops were bulky but the quality was inferior, the wet weather causing growth but the lack of sunshine preventing development. Nor were there wanting—as usually happens under the diversified agricultura conditions of the British Isles—instances of widely different results, sometimes even in the same neighbourhood.

Final Report of the Departmental Committee on Butter Regulations. [Cd. 1749.] Price 3d. Minutes of Evidence. [Cd. 1750.] Price 7s. 5d.

This Committee issued in 1902 an Interim Report,* in which they unanimously recommended the adoption of a limit of

* *Journal of the Board of Agriculture*, Vol. viii., p. 546.

16 per cent. for the proportion of water in butter; and in the present Report they deal with the results of their enquiries concerning the other matters referred to in the minute of appointment—viz., as to what regulations, if any, might with advantage be made under Section 4 of the Sale of Food and Drugs Act, 1899, for determining what deficiency in any of the normal constituents of butter, or what addition of extraneous matter other than water, should raise a presumption until the contrary is proved that the butter is not genuine.

The Committee, with the exception of one member who presents a Minority Report, recommend:—(1) That the figure 24 arrived at by the Reichert-Wollny method should be the limit, below which a presumption should be raised that butter is not genuine. (2) That the use of 10 per cent. of sesamé oil in the manufacture of margarine be made compulsory. (3) That steps should be taken to obtain international co-operation.

The Report contains Notes of Reservation by three members, of whom two recommend a limit of 23 for the Reichert-Wollny figure. The Minutes of Evidence include a large number of appendices and diagrams.

Report of the Committee of Council on Education in Scotland, 1902–3. [*Cd.* 1593]. *Price* 3*s.* 10*d.*

The sum available for agricultural education in Scotland in the year 1902-3, including a balance of £255 17s. 6d. from the preceding year, was £4,255 17s. 6d., and the following table shows the sums actually distributed to the various institutions in 1902-3 as compared with the preceding year:—

Institution, &c.	Sums paid. 1901–1902.			Sums paid. 1902–1903.		
	£	s.	d.	£	s.	d.
Aberdeen University (Agricultural Department)	500	0	0	500	0	0
Edinburgh and East of Scotland Coll. of Agriculture	1,780	0	0	1,650	0	0
West of Scotland Agricultural College	2,350	0	0	2,041	0	0
Expenses of Inspection, &c.	61	11	2	64	17	6
Totals	£4,691	11	2	£4,255	17	6

LIVE WEIGHT PRICES OF CATTLE.

The returns furnished to the Board of Agriculture and Fisheries under the Markets and Fairs (Weighing of Cattle) Act, 1891, during the last quarter of 1903, enable the complete figures for that year to be compiled. These returns, in addition to the information which they furnish of the fluctuations in the value of cattle in certain typical markets of Great Britain, afford some indication of the growth since 1893 of the practice of selling stock by live weight.

The list of towns from which returns are received is given in Table I on page 558, and including Carlisle and Falkirk, which were added in 1898, they now number fifteen in England and six in Scotland.

The relation of the number of cattle returned as weighed to the total number entering the scheduled markets in each year is shown in the table on the next page. Whereas in 1893 the proportion was only 7·59 per cent., in 1903 it had risen to 14·53 per cent., having exhibited during the whole of the period a slow but continuous increase, each succeeding year showing a higher percentage than its predecessor; and the total number weighed during the past two years having been almost exactly double that returned in 1893. These figures, which include returns from markets where no use whatever is made of the weigh-bridges provided, as well as from towns where a substantial proportion of the animals exposed for sale are weighed either before or after being sold, may fairly be held to indicate that the recognition by farmers generally of the advantage to be derived from a precise knowledge of the weight of their animals is gradually but steadily extending.

Years.	Cattle Entering the Scheduled Markets.	Cattle Returned as Weighed.	Proportion of Number Weighed to Number Entering.
	No.	No.	Per cent.
1893	1,219,208	92,492	7·59
1894	1,203,533	96,344	8·01
1895	1,186,149	100,033	8·43
1896	1,000,014	109,184	9·93
1897	1,115,183	111,767	10·02
1898	1,263,991	138,652	10·97
1899	1,236,091	139,482	11·28
1900	1,187,603	141,611	11·92
1901	1,161,516	156,289	13·46
1902	1,302,601	184,499	14·16
1903	1,262,301	183,466	14·53

The difference between the favour shown to weighing in Scotland and in England is still very marked. In the six Scottish markets the proportion ranges from about 22½ per cent. at Glasgow to 53 per cent. at Dundee, and averages on the whole no less than 35½ per cent. of the number entering those markets. In England, on the other hand, the average is only about 9 per cent., the proportion varying from under 4 per cent. at Leicester, Newcastle, and Salford to 15½ per cent. at Carlisle 18½ per cent. at Liverpool, 23 per cent. in London, and 48 per cent. at Shrewsbury, while at Ashford, Birmingham, Bristol, Lincoln, Norwich, and York the use of the weighbridge appears to be comparatively rare.

In addition to the six markets named above as making no appreciable use of the weighing machine, the two markets of Salford and Wakefield fail to furnish any sufficient particulars as regards prices realized, although 4,195 head of cattle were weighed at the former and 6,006 head at the latter during the past year. Details relating to values are consequently available only in the case of the thirteen markets named in the following table.

Places.	Prime or First Quality.			Good or Second Quality.			Inferior or Third Quality.		
	Number.	Price per Stone.	Price per Cwt.	Number.	Price per Stone.	Price per Cwt.	Number.	Price per Stone.	Price per Cwt.
		s. d.	s. d.		s. d.	s. d.		s. d.	s. d.
Carlisle ...	7,257	4 5¼	35 6	1,933	3 10	30 8	1,450	3 5¼	27 6
Leicester ...	1,339	4 3¼	34 2	384	3 10¾	31 0	3	2 4¼	18 10
Leeds	2,041	4 5¼	35 6	954	3 11¾	31 10	—	—	—
Liverpool ...	6,435	4 3¾	34 6	2,740	3 9¼	30 2	890	3 3¾	26 6
London ...	2,916	4 8¾	37 10	1,643	4 2¾	33 10	6	3 7	28 8
Newcastle ...	2,840	4 8¼	37 6	387	4 2	33 4	—	—	—
Shrewsbury..	574	4 6¼	36 2	988	4 2¾	33 10	586	3 9	30 0
Aberdeen ...	8.337	4 7¾	37 2	7,637	4 3¾	34	5,573	3 3⅜	26 6
Dundee ...	2,602	4 8½	37 8	4,755	4 3¾	34 6	2,031	3 1½	25 0
Edinburgh...	864	4 8¼	37 8	12,582	4 5	35 4	19	4 0	32 0
Falkirk ...	1,254	4 7¾	37 2	1,684	4 4¼	34 10	1,065	3 10	30 8
Glasgow ...	7,456	4 7	36 8	2,483	4 5¾	35 10	1,015	4 3¼	34 4
Perth	2,238	4 8	37 4	2,422	4 3¼	34 4	880	3 10¾	31 2

The animals returned as prime quality averaged 34s. 2d. and 34s. 6d. per cwt. at Leicester and Liverpool respectively, 35s. 6d. at Carlisle and Leeds, 36s. 2d. and 36s. 8d. at Shrewsbury and Glasgow, while at the remaining markets they fetched over 37s. per cwt., reaching a maximum of 37s. 10d. in London. In the case of second quality animals the range was from 30s. 2d. at Liverpool to 35s. 10d. at Glasgow, the price at all the Scottish markets being over 34s., while in the English markets the highest average recorded gives 33s. 10d. per cwt., which was reached both at Shrewsbury and London.

Only at eight of these markets can the course of prices be compared over the whole period of eleven years, but the figures for first quality animals so far as they are available, are shown in the following table :—

It will be seen that from 1893 to 1896 prices generally showed a tendency to fall, though in several markets there was an

improvement in 1895 as compared with 1894 In 1897 prices rose, but fell again in 1898, when minimum figures were recorded

Years.	Quality Cattle.															
	Liverpool.		London.		Newcastle.		Shrewsbury.		Aberdeen.		Dundee.		Edinburgh.		Perth.	
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
1893	34	6	39	4	35	10	32	6	37	4	35	4	36	0	35	4
1894	32	4	38	6	35	4	34	4	36	2	34	1	34	2	34	4
1895	33	8	38	0	35	4	33	10	36	8	35	3	35	1	35	11
1896	32	4	37	0	33	10	34	4	34	10	33	6	33	4	33	10
1897	32	8	38	10	36	2	34	6	36	0	35	2	[illegible]	8	35	10
1898	31	10	36	6	33	4	34	2	34	8	33	8	34	0	34	8
1899	33	6	38	0	36	2	34	10	36	10	35	2	36	6	35	6
1900	35	4	39	4	38	8	36	6	38	2	37	10	38	4	38	8
1901	34	2	38	4	36	10	35	8	36	4	37	0	37	10	37	10
1902	36	2	40	6	39	8	37	4	39	0	39	8	40	0	39	0
1903	34	6	37	10	37	6	36	2	37	2	37	8	37	8	37	4

at three English markets and at Aberdeen, whilst the lowest level was touched at the three remaining Scottish markets in 1896. The difference, however, between the prices of 1896 and 1898 was very slight. Prices had a rising tendency in 1899 and 1900, but declined again in 1901. In 1902 there was a marked rise of from two to three shillings per cwt., and the price of each of the markets reached a higher point than in any other recorded year.

The returns on which the above particulars are based, together with those from the remaining five markets for which figures are not available throughout the whole period, afford material for ascertaining what may be regarded as an average yearly value for the two higher grades of cattle in Great Britain as a whole. This average price, which is given in the next table, has been calculated for the past six years by dividing the total recorded

value by the aggregate weight of the animals for which particulars are furnished.

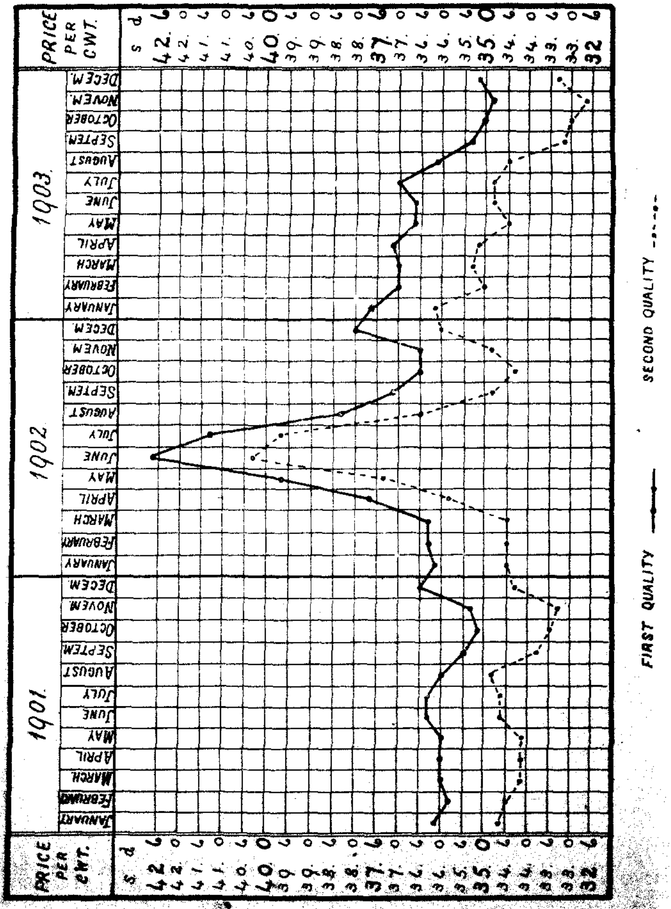
In 1903 the average prices of prime or first quality animals declined by 1s. 8d. per cwt., and of second quality by

Years.	Prime or First Quality.			Good or Second Quality.		
	Number.	Price per Cwt.		Number.	Price per Cwt.	
		s.	d.		s.	d.
1898	36,898	33	8	45,854	31	10
1899	43,448	35	6	37,964	33	4
1900	43,905	37	0	36,779	34	10
1901	41,126	36	0	39,903	34	2
1902	50,755	38	0	36,838	35	10
1903	46,153	36	4	40,592	34	4

1s. 6d. per cwt. compared with 1902, but it still remains from 2s. 8d. to 2s. 6d. per cwt. above the level of 1898, which, judging by the evidence given in the previous table, was probably the minimum year since these returns have been collected.

In addition to the above, figures ascertained monthly in a similar manner are also available, and are shown for 1903 and the two preceding years in the table on the next page. The course of these prices is also indicated by the annexed diagram.

In December, 1902, the price recorded for the best beasts was 38s. per cwt.; in the following month it fell to 37s. 8d., and, as will be seen from the diagram, it remained comparatively steady, though with a falling tendency, until July, but in August a marked decline became apparent. In September the price was 35s. 4d., and in November 34s. 10d. per cwt., the lowest point, not only of the year, but of any month since October, 1899. The usual rise in the price of fat stock occurred in December, but it was much less in amount than in the two preceding years, and the year closed with values at 35s. 2d. per cwt. for first quality and 33s. 4d. per cwt. for second quality animals.


PRICE PER CWT.
1901
1902
1903
FIRST QUALITY
SECOND QUALITY

Month.	Prime or First Quality.			Good or Second Quality.		
	1903.	1902.	1901.	1903.	1902.	1901.
	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.	Per cwt. s. d.
January	37 8	36 2	36 2	36 2	34 6	34 8
February... ...	37 0	36 4	35 10	35 0	34 6	34 6
March	37 0	36 4	36 0	35 4	34 6	34 2
April	37 2	37 8	36 0	35 2	35 10	34 2
May	36 8	39 8	36 0	34 6	37 4	34 2
June	36 8	42 8	36 4	34 10	40 4	34 8
July	37 0	41 4	36 4	34 10	39 8	34 8
August	36 2	38 4	36 0	34 6	36 6	34 10
September ...	35 4	37 2	35 6	33 2	34 10	33 10
October	35 0	36 6	35 2	33 0	34 4	33 6
November ...	34 10	36 6	35 4	32 8	34 10	33 4
December ...	35 2	38 0	36 6	33 4	36 0	34 4

The number of store cattle weighed, for which prices were recorded, was 23,070 compared with 19,464 in 1902 and 14,054 in 1901. Of this total 19,831 were reported from Shrewsbury, where an average price of 36s. 10d. per cwt. appears to have been realized for first quality animals, 33s. 6d. for second, and 29s. 10d. per cwt. for third quality.

The number of recorded sales of fat cattle at an agreed price per cwt., or per stone, live weight in 1903 was 11,439, and these actual sales by weight were reported from eleven markets.

The usual tables, giving particulars for the whole year and for the fourth quarter of 1903, are appended.

I.—CATTLE, SHEEP, AND SWINE, *entering and weighed at the Markets and Marts of the undermentioned Places in the* YEAR **1908**, *as returned under the Markets and Fairs (Weighing of Cattle) Act*, 1891 (54 *and* 55 *Vict. c.* 70).

PLACES.	Cattle.			Sheep.			Swine.		
	Total Number entering the Markets or Marts.	Number Weighed.	Number Weigh'd for which Prices were given.	Total Number entering the Markets or Marts.	Number Weighed.	Number Weigh'd for which Prices were given.	Total Number entering the Markets or Marts.	Number Weighed.	Number Weigh'd for which Prices were given.
ENGLAND.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
Ashford ...	12,751	65	—	90,606	—	—	24,793	—	—
Birmingham ...	19,333	—	—	63,266	—	—	245,804	—	—
Bristol	73,080	—	—	83,546	—	—	—	—	—
Carlisle ...	68,743	10,640	10,640	286,557	—	—	14,712	—	—
Leicester ...	61,725	2,291	2,056	76,441	25	25	8,781	—	—
Leeds	35,784	2,995	2,995	119,075	1,190	1,190	118	—	—
Lincoln ...	10,502	1	1	67,985	—	—	14,352	160	160
Liverpool ...	54,473	10,065	10,065	396,156	6,086	6,086	364	1	1
London ...	68,520	15,627	4,565	494,830	4,692	—	1,650	—	—
Newcastle-upon-Tyne ...	97,288	3,227	3,227	342,896	—	—	40,922	2,262	2,262
Norwich ...	124,199	202	138	151,481	—	—	32,060	—	—
Salford ...	105,626	4,195	—	524,990	—	—	2,614	—	—
Shrewsbury ...	69,966	33,629	21,979	80,865	—	—	33,254	—	—
Wakefield ...	74,773	6,006	473	182,453	1,217	293	8,761	186	150
York	120,384	45	45	185,228	—	—	7,935	87	87
SCOTLAND.									
Aberdeen ...	47,757	21,781	21,781	175,722	19,087	19,087	14,344	—	—
Dundee ...	17,896	9,478	9,478	25,748	2,231	2,231	3,223	—	—
Edinburgh ...	71,926	32,370	*16,004	269,310	530	500	10,054	—	—
Falkirk ...	11,383	4,003	4,003	10,396	—	—	120	—	—
Glasgow ...	60,550	13,715	10,956	348,496	270	47	5,450	2	—
Perth	55,642	13,131	*5,540	247,830	1,351	1,351	13,921	336	336
TOTAL for ENGLAND ...	997,147	88,988	56,184	3,146,375	13,210	7,594	436,120	2,696	2,660
TOTAL for SCOTLAND ...	265,154	94,478	*67,762	1,077,502	23,469	23,216	47,112	338	336
Total ...	1,262,301	183,466	*123,946	4,223,877	36,679	30,810	483,232	3,034	2,996

* Prices for 16,366 cattle in addition to the above were quoted from Edinburgh and for 7,591 cattle from Perth, but without distinguishing the quality.

II.—CATTLE, SHEEP, AND SWINE *entering and weighed at the Markets and Marts of the undermentioned Places, in the* FOURTH QUARTER *of* **1903**, *as returned under the Markets and Fairs (Weighing of Cattle) Act*, 1891 (54 *and* 55 *Vict. c.* 70).

PLACES.	Cattle.			Sheep.			Swine.		
	Total Number entering the Markets or Marts.	Number Weighed.	Number Weigh'd for which Prices were given.	Total Number entering the Markets or Marts.	Number Weighed.	Number Wgh'd for which Prices were given.	Total Number entering the Markets or Marts.	Number Weighed.	Number Wgh'd for which Prices were given.
ENGLAND.	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*
Ashford ...	3,816	6	—	21,094	—	—	8,122	—	—
Birmingham ...	3,732	—	—	11,767	—	—	72,662	—	—
Bristol... ...	18,539	—	—	13,883	—	—	—	—	—
Carlisle ...	22,169	2,482	2,482	71,189	—	—	4,902	—	—
Leicester ...	17,689	875	803	24,746	25	25	2,823	—	—
Leeds	7,978	701	701	22,780	—	—	5	—	—
Lincoln ...	2,724	—	—	13,838	—	—	3,804	—	—
Liverpool ...	18,154	4,435	4,435	73,595	1,433	1,433	19	—	—
London ...	19,640	5,208	1,245	95,460	920	—	1,040	—	—
Newcastle-upon-Tyne ...	26,113	383	383	79,178	—	—	15,228	553	553
Norwich ...	37,868	24	11	17,401	—	—	7,368	—	—
Salford ...	31,412	1,370	—	94,188	—	—	684	—	—
Shrewsbury ...	19,000	10,793	6,142	17,225	—	—	8,720	—	—
Wakefield ...	19,854	2,041	55	38,383	—	—	1,993	20	—
York	43,053	1	1	96,565	—	—	2,754	—	—
SCOTLAND.									
Aberdeen ...	13,568	5,384	5,384	31,650	5,321	5,321	3,773	—	—
Dundee ...	3,993	2,153	2,153	6,809	768	768	891	—	—
Edinburgh ...	23,459	10,427	*6,144	61,028	—	—	2,914	—	—
Falkirk ...	3,249	1,095	1,095	2,954	—	—	42	—	—
Glasgow ...	15,707	3,229	2,635	94,272	151	7	1,424	—	—
Perth... ...	13,789	1,956	*905	68,723	353	353	3,639	88	88
TOTAL for ENGLAND ...	291,741	28,319	16,258	691,292	2,378	1,458	130,124	573	553
TOTAL for SCOTLAND ...	73,765	24,244	*18,316	265,436	6,593	6,449	12,683	88	88
Total ...	365,506	52,563	*34,574	956,728	8,971	7,907	142,807	661	64

* Prices for 4,283 cattle in addition to the above were quoted from Edinburgh and for 1,051 cattle from Perth, but without distinguishing the quality.

III.—CATTLE, SHEEP, AND SWINE, *entering, weighed, and priced at the Scheduled Places in Great Britain, in the* FOURTH QUARTERS *of* **1903** and **1902**, *with the totals for each year.*

Animals.	4th Quarter, 1903.	4th Quarter, 1902.	Total for the year 1903.	Total for the year 1902.
CATTLE:	No.	No.	No.	No.
Entering markets ...	365,506	393,945	1,262,301	1,302,601
Weighed	52,563	54,632	183,466	184,499
Prices returned ...	39,908	41,276	147,903	145,996
Prices returned with quality distinguished	34,574	35,519	123,946	121,453
SHEEP:				
Entering markets ...	956,728	1,036,490	4,223,877	4,508,045
Weighed	8,971	10,486	36,679	42,832
Prices returned with quality distinguished	7,907	8,890	30,810	34,695
SWINE:				
Entering markets ...	142,807	124,649	483,232	414,351
Weighed	661	893	3,034	2,722
Prices returned with quality distinguished	641	790	2,996	2,585

IV.—*Prices of* FAT CATTLE *in the* FOURTH QUARTER *of* **1903**.

PLACES.	PRIME or First Quality.			GOOD or Second Quality.			INFERIOR or Third Quality.		
	Number.	Price per Stone.	Price per Cwt.	Number.	Price per Stone.	Price per Cwt.	Number.	Price per Stone.	Price per Cwt.
		s. d.	s. d.		s. d.	s. d.		s. d.	s. d.
Carlisle ...	1,398	4 4½	35 0	653	3 9¾	30 6	431	3 4¾	27 2
Leicester ...	450	4 1	32 8	245	3 10½	31 0	—	—	—
Leeds ...	509	4 4½	35 0	192	3 11	31 4	—	—	—
Liverpool ...	2,734	4 2½	33 8	1,444	3 8	29 4	257	3 0¾	24 6
London ...	572	4 5¾	35 10	673	4 1	32 8	—	—	—
Newcastle ...	254	4 6	36 0	129	4 0¼	32 2	—	—	—
Shrewsbury	71	4 2¼	33 6	148	3 10¾	31 2	140	3 6½	28 4
Aberdeen ...	1,867	4 6¾	36 6	2,306	4 2¾	33 10	1,176	3 1¾	25 2
Dundee ...	551	4 8	37 4	1,056	4 2¾	33 10	486	2 10¾	23 2
Edinburgh ...	134	4 8	37 4	3,866	4 2¾	33 10	11	3 9½	30 4
Falkirk ...	177	4 5½	35 8	383	4 1½	33 0	535	3 8½	29 8
Glasgow ...	1,728	4 4½	35 0	620	4 4	34 8	285	4 1½	33 0
Perth ...	246	4 7	36 8	406	4 2½	33 8	253	3 9¾	30 6

PRICES OF MEAT, CORN, AND DAIRY PRODUCE.

AVERAGE PRICES of DEAD MEAT, per 8 lb., at the LONDON CENTRAL MEAT MARKET, during the Fourth Quarter of 1903, and during the Months of December, 1903, and January and February, 1904.

(Compiled from the prices quoted weekly in the "Meat Trates' Journal.")

DESCRIPTION.	4TH QUARTER, 1903.	DECEMBER, 1903.	JANUARY, 1904.	FEBRUARY, 1904.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
BEEF :—				
Scotch, short sides	4 2 to 4 6	4 1 to 4 4	4 0 to 4 3	3 10 to 4 1
" long sides	3 9 " 3 11	3 8 " 3 11	3 7 " 3 10	3 7 " 3 9
English...	3 3 " 3 7	3 3 " 3 7	3 2 " 3 6	3 2 " 3 7
Cows and Bulls	2 0 " 2 10	2 0 " 2 9	1 11 " 2 10	1 11 " 2 8
American, Birkenhead killed...	3 0 " 3 4	3 0 " 3 5	3 1 " 3 5	2 11 " 3 3
" Deptford killed ...	3 0 " 3 6	3 1 " 3 7	3 1 " 3 6	3 0 " 3 5
Canadian Ranchers	2 6 " 2 10	2 5 " 2 9	—	—
American, Refrig. hind-quarters	3 7 " 3 10	3 7 " 3 10	3 2 " 3 6	3 3 " 3 7
" " fore-quarters	2 2 " 2 4	2 3 " 2 5	2 0 " 2 3	2 3 " 2 5
Australian, Frozen, hind-quarters	2 0 " —	2 0 " —	1 11 " 2 0	1 10 " 1 11
" " fore-quarters	1 6 " —	1 6 " —	1 8 " —	1 8 " —
NewZealand, Frzn. hind-quarters	2 4 " 2 5	2 2 " 2 4	2 4 " —	2 1 " 2 3
" " fore-quarters	1 8 " —	1 8 " —	1 8 " —	1 9 " 1 10
River Plate, " hind-quarters	2 3 " —	2 1 " 2 2	2 1 " —	2 0 " —
" " fore-quarters	1 7 " —	1 7 " —	1 8 " —	1 9 " 1 10
" Chilled hind-quarters	2 7 " 2 8	2 9 " —	2 3 " 2 5	2 3 " —
" " fore-quarters	1 8 " 1 9	1 10 " —	1 8 " 1 9	1 10 " 1 11
MUTTON :—				
Scotch	4 6 " 4 11	4 6 " 5 0	4 6 " 5 1	4 6 " 5 1
English	3 10 " 4 7	3 11 " 4 9	4 0 " 4 9	4 1 " 4 9
Ewes	2 11 " 3 5	3 0 " 3 6	2 11 " 3 5	3 1 " 3 8
Continental	3 5 " 3 11	3 4 " 3 11	3 8 " 4 4	—
New Zealand, Frozen... ...	2 3 " 2 9	2 1 " 2 9	2 5 " 2 11	2 6 " 3 1
Australian, Frozen	2 1 " 2 2	2 1 " 2 2	2 5 " 2 6	2 6 " —
River Plate, Frozen	2 3 " —	2 2 " —	2 6 " —	2 7 " —
LAMB :—				
English	4 4 " 4 8	—	—	—
New Zealand, Frozen... ...	3 1 " 3 4	3 1 " 3 2	3 1 " 3 2	4 1 " 4 3
Australian "	3 0 " —	3 0 " —	2 11 " 3 4	3 2 " 3 8
VEAL :—				
Best	4 6 " 5 0	4 7 " 5 1	4 7 " 5 0	4 7 " 5 3
Secondary and middling ...	3 8 " 4 4	3 9 " 4 5	3 7 " 4 4	3 8 " 4 4
PORK :—				
English, best	3 7 " 3 11	3 5 " 3 9	3 2 " 3 6	3 2 " 3 6
" seconds and thirds ...	2 11 " 3 3	2 9 " 3 2	2 9 " 3 1	2 7 " 3 0

AVERAGE PRICES OF DEAD MEAT, per 8 lb., at the LONDON CENTRAL MEAT MARKET, during the Years 1899 to 1903 inclusive.

(Compiled from the prices quoted weekly in the "Meat Trades' Journal.")

DESCRIPTION.	1899.	1900.	1901.	1902.	1903.
BEEF :—	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
Scotch, short sides ...	4 3 to 4 6	4 5 to 4 8	4 2 to 4 5	4 8 to 5 0	4 3 to 4 6
„ long sides ...	3 11 „ 4 1	4 0 „ 4 3	3 11 „ 4 1	4 3 „ 4 6	3 11 „ 4 1
English	3 9 „ 3 11	3 10 „ 4 0	3 9 „ 3 11	4 1 „ 4 4	3 7 „ 3 10
Cow and Bull	2 0 „ 2 10	2 1 „ 3 2	2 1 „ 3 2	2 2 „ 3 5	2 2 „ 3 2
American. Birkenh'd kill'd	3 5 „ 3 8	3 8 „ 3 10	3 6 „ 3 9	3 11 „ 4 1	3 4 „ 3 7
„ Deptford killed	3 6 „ 3 9	3 8 „ 3 11	3 7 „ 3 10	4 0 „ 4 3	3 5 „ 3 9
American Refrig. hind-qrs	3 7 „ 3 10	3 10 „ 4 0	3 8 „ 3 10	4 4 „ 4 7	3 7 „ 3 10
„ „ fore-qrs	2 4 „ 2 6	2 8 „ 2 10	2 4 „ 2 7	2 11 „ 3 2	2 5 „ 2 7
Australian, Froz'n hind-qrs	2 1 „ 2 4	2 5 „ 2 7	2 3 „ 2 4	2 8 „ 2 9	2 5 „ —
„ „ fore-qrs	1 8 „ 1 9	2 1 „ 2 2	1 9 „ —	2 2 „ 2 3	2 0 „ —
New Zealand, „ hind-qrs	2 3 „ 2 6	2 7 „ 2 9	2 6 „ 2 7	3 3 „ 3 4	2 9 „ —
„ „ „ fore-qrs	1 9 „ 1 11	2 2 „ 2 3	1 10 „ 1 11	2 7 „ —	1 11 „ 2 0
MUTTON :—					
Scotch	4 5 „ 4 11	4 9 „ 5 2	4 6 „ 4 10	4 6 „ 4 11	4 9 „ 5 3
English	4 2 „ 4 8	4 6 „ 4 11	4 2 „ 4 8	4 3 „ 4 8	4 3 „ 4 10
Ewes	3 1 „ 3 6	3 4 „ 3 9	3 3 „ 3 8	3 2 „ 3 8	3 4 „ 3 10
Continental	3 9 „ 4 2	4 1 „ 4 6	3 11 „ 4 4	4 0 „ 4 4	3 7 „ 4 1
New Zealand, Frozen ...	1 11 „ 2 8	2 4 „ 2 9	2 1 „ 2 10	2 4 „ 2 10	2 4 „ 3 0
Australian, Frozen ...	1 10 „ 2 0	2 3 „ 2 4	1 11 „ 2 1	2 3 „ 2 4	2 3 „ —
River Plate, Frozen ...	1 11 „ 2 0	2 3 „ 2 5	2 1 „ 2 2	2 5 „ 2 6	2 5 „ 2 6
LAMB :—					
English	5 0 „ 6 2	5 6 „ 6 4	5 6 „ 6 5	5 2 „ 6 2	5 2 „ 6 2
New Zealand, Frozen ...	2 11 „ 3 3	3 1 „ 3 5	3 3 „ 3 8	3 4 „ 3 7	3 4 „ 3 8
VEAL :—					
Best	4 4 „ 4 9	4 4 „ 4 9	4 6 „ 4 10	4 6 „ 4 11	4 7 „ 5 1
Seconds and Middling ...	3 8 „ 4 2	3 10 „ 4 3	3 7 „ 4 4	3 9 „ 4 4	3 9 „ 4 5
PORK :—					
Best	3 6 „ 3 11	3 10 „ 4 2	4 3 „ 4 8	4 4 „ 4 8	3 9 „ 4 1
Seconds and Thirds ...	3 0 „ 3 5	3 4 „ 3 9	3 7 „ 4 0	3 7 „ 4 0	3 2 „ 3 6

AVERAGE WHOLESALE PRICES of CATTLE and SHEEP, per 8 lb., sinking the offal, at the METROPOLITAN CATTLE MARKET, during each Quarter of 1903, with the Mean Prices for the year.

PERIOD.	CATTLE.			SHEEP.		
	Inferior.	Second.	First.	Inferior.	Second.	First.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1st Quarter, 1903	3 2	4 5	4 11	3 8	5 5	6 2
2nd Quarter, ,,	2 9	4 0	4 7	3 8	5 1	5 9
3rd Quarter, ,,	2 10	4 1	4 7	3 8	4 11	5 8
4th Quarter, ,,	2 5	3 10	4 6	3 8	5 0	5 10
Year - - -	2 10	4 1	4 8	3 8	5 1	5 10

AVERAGE WHOLESALE PRICES of BEEF and MUTTON, per 8 lb., by the Carcase, at LIVERPOOL and GLASGOW, during each Quarter of 1903, with the Mean Prices for the year.

PERIOD.	LIVERPOOL.*		GLASGOW.†	
	BEEF.	MUTTON.	BEEF.	MUTTON.
	s. d. s. d.	s. d. s. d.	s. d. s. d.	s. d. s. d.
1st Quarter, 1903	2 8 to 4 2	4 0 to 6 0	3 8 to 4 10	5 0 to 6 4
2nd Quarter, ,,	2 10 ,, 4 2	4 0 ,, 5 10	4 2 ,, 4 8	5 4 ,, 6 8
3rd Quarter, ,,	3 0 ,, 3 10	3 2 ,, 5 2	3 8 ,, 4 10	4 0 ,, 6 2
4th Quarter, ,,	2 8 ,, 3 10	3 4 ,, 5 2	3 0 ,, 4 0	2 4 ,, 5 4
Year - - -	2 9 ,, 4 0	3 7 ,, 5 6	3 7 ,, 4 7	4 2 ,, 6 1

* Compiled from information furnished by the Medical Officer of Health, Liverpool. The prices quoted are for Carcases of Animals *slaughtered at the Liverpool Abattoir*, and do not apply to Imported Meat.

† Compiled from information furnished by the Principal of the Veterinary College, Glasgow.

CHICAGO.

AVERAGE PRICES of CATTLE at CHICAGO per cwt. (Live Weight) in the under-mentioned Months of 1903 and 1904, with the Mean Prices for the Year 1903.

MONTH.	Medium to Good Steers.	Good to Choice Steers.	Choice to Extra Prime Steers.
	s. d. s. d.	s. d. s. d.	s. d. s. d.
December, 1903 ..	20 10 to 22 7	23 2 to 24 8	24 11 to 27 2
Mean of the year 1903 ...	21 10 ,, 23 7	23 11 ,, 25 8	25 9 ,, 27 9
January, 1904 ...	21 4 .. 23 3	23 4 ,, 25 5	25 5 ,, 27 5
February, ,, ...	18 9 ,, 22 3	22 10 ,, 26 2	26 3 ,, 27 9

Compiled from the Live Stock Reports issued by Messrs. Clay, Robinson and Co., of the Union Stock Yards, Chicago.

AVERAGE VALUES, per cwt., of various Kinds of DEAD MEAT Imported into the United Kingdom from FOREIGN COUNTRIES and BRITISH POSSESSIONS in each Quarter of 1903, with the Average Values for the year.

(Computed from the Trade and Navigation Accounts.)

PERIOD.	BEEF.		MUTTON.	PORK.		BACON.	HAMS.
	Fresh.	Salted.	Fresh.	Fresh.	Salted.		
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1st Quarter, 1903...	41 9	34 3	39 8	44 8	31 0	52 9	54 0
2nd Quarter, ,, ..	41 6	28 11	39 9	43 8	26 6	53 4	54 9
3rd Quarter, ,, ...	39 5	25 5	38 6	43 10	25 3	53 7	56 7
4th Quarter, ,, ...	38 6	24 4	37 4	43 10	26 0	51 6	54 5
Year	40 3	28 3	39 0	44 1	26 11	52 10	55 1

BERLIN MARKET.

AVERAGE PRICES of CATTLE, SHEEP, and SWINE (Dead Weight) in the BERLIN CATTLE MARKET in the undermentioned Months of 1903 and 1904, together with the Mean Prices for the Year 1903.

MONTHS.	OXEN.	SHEEP.	SWINE.
	Per Cwt.	Per Cwt.	Per Cwt.
	s. *d.*	*s.* *d.*	*s.* *d.*
November, 1903	69 1	70 3	48 10
December ,, ...	67 10	68 9	47 3
Mean of the Year 1903...	65 8	67 8	50 9
January, 1904	67 5	65 3	46 4

NOTE.—The above prices are compiled from the Wholesale Prices quoted in the *Monatliche Nachweise über den auswärtigen Handel des deutschen Zollgebiets.* The prices for swine are live weight prices with 20 per cent. tare.

CORN PRICES:—ANNUAL AVERAGES.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Weekly Averages of Corn Returns from the Returning Markets, together with the QUANTITIES returned as sold at such Markets during each of the years 1897 to 1903.

YEARS.	PRICES.			QUANTITIES.		
	Wheat.	Barley.	Oats.	Wheat.	Barley.	Oats.
	s. *d.*	*s.* *d.*	*s.* *d.*	*Quarters.*	*Quarters.*	*Quarters.*
1897 ...	30 2	23 6	16 11	2,756,561	3,257,187	550,434
1898 ...	34 0	27 2	18 5	2,602,416	3,653,657	688,064
1899 ...	25 8	25 7	17 0	3,530,961	3,296,744	776,361
1900 ...	26 11	24 11	17 7	2,923,483	3,190,793	711,784
1901 ...	26 9	25 2	18 5	2,605,550	3,369,629	714,215
1902 ...	28 1	25 8	20 2	2,247,937	2,783,424	831,285
1903 ...	26 9	22 8	17 2	2,296,723	2,875,749	1,049,995

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels,* computed from the Weekly Averages of Corn Returns from the Returning Markets of ENGLAND AND WALES, pursuant to the Corn Returns Act, 1882, together with the QUANTITIES returned as sold at such Markets, in the under-noted periods of the Years 1903, 1902, and 1901.

QUARTER ENDED	PRICES. 1903.	PRICES. 1902.	PRICES. 1901.	QUANTITIES. 1903.	QUANTITIES. 1902.	QUANTITIES. 1901.
Wheat.						
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	25 2	27 3	26 3	694,912	826,066	744,018
Midsummer ...	26 11	29 10	27 1	639,441	444,639	547,737
Michaelmas ...	28 8	30 2	26 11	307,834	222,495	535,109
Christmas ...	26 3	25 0	26 7	654,536	754,737	778,686
Barley.						
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	23 5	26 8	25 3	975,720	669,251	844,616
Midsummer ...	22 2	25 6	24 9	98,961	40,875	53,408
Michaelmas ...	21 6	25 1	24 0	28,938	32,318	236,164
Christmas ...	23 8	25 5	26 8	1,772,130	2,040,980	2,235,441
Oats.						
	s. d.	*s. d.*	*s. d.*	*Quarters.*	*Quarters.*	*Quarters.*
Lady Day ...	16 11	20 3	17 6	372,119	239,048	236,316
Midsummer ...	18 0	22 1	19 3	188,528	88,274	81,172
Michaelmas ...	18 0	21 3	18 7	120,931	101,130	131,023
Christmas ...	15 8	17 0	18 4	368,417	402,833	265,704

* Section 8 of the Corn Returns Act, 1882, provides that where returns of purchases of British Corn are made to the local inspector of Corn Returns in any other measure than the imperial bushel or by weight or by a weighed measure, that officer shall convert such returns into the imperial bushel, and in the case of weight or weighed measure the conversion is to be made at the rate of 60 imperial pounds for every bushel of wheat, 50 imperial pounds for every bushel of barley, and 39 imperial pounds for every bushel of oats.

AVERAGE PRICES of **British Corn** per Quarter of 8 Imperial Bushels, computed from the Returns received under the Corn Returns Act, 1882, in each of the under-mentioned Weeks in 1904, and in the corresponding Weeks in 1903 and 1902.

Weeks ended (*in* 1904).	Wheat.			Barley.			Oats.		
	1902.	1903.	1904.	1902.	1903.	1904.	1902.	1903.	1904.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Jan. 2 ...	27 7	25 0	26 3	26 7	23 11	22 1	19 10	16 10	15 5
,, 9 ...	27 8	24 11	26 6	26 7	24 1	22 6	20 0	17 0	15 7
,, 16 ...	27 8	24 11	26 11	26 11	24 1	22 3	20 0	16 10	15 9
,, 23 ...	27 7	25 0	27 3	26 7	24 1	22 4	20 3	16 11	15 11
,, 30 ...	27 4	25 4	26 11	26 7	24 3	22 3	20 2	17 0	15 8
Feb. 6 ...	27 2	25 6	26 9	26 9	23 9	22 4	20 3	16 11	15 11
,, 13 ...	26 11	25 6	26 8	26 5	23 7	22 2	20 3	17 1	15 9
,, 20 ...	27 1	25 4	26 11	26 1	23 4	22 7	20 4	17 1	16 0
,, 27 ...	27 1	25 3	27 10	26 11	23 2	22 4	20 5	17 1	16 3
Mar. 5 ...	27 0	25 3	28 8	26 8	23 1	22 6	20 5	17 1	16 5
,, 12 ...	27 1	25 1	29 1	26 8	22 10	22 5	20 6	17 0	16 8
,, 19 ...	27 1	25 1		26 6	22 9		20 6	16 10	
,, 26 ...	27 2	25 2		26 4	22 4		20 7	17 0	
A,pl. 2 ...	27 3	25 3		27 2	22 6		20 6	17 0	
,, 9 ...	27 5	25 4		26 5	21 10		21 0	17 2	
,, 16 ...	27 7	25 6		26 7	21 6		21 1	17 3	
,, 23 ...	28 9	26 1		27 1	21 9		21 6	17 9	
,, 30 ...	29 9	26 10		26 5	22 1		21 10	18 0	
May 7 ...	30 9	27 6		27 5	21 10		22 6	18 2	
,, 14 ...	31 1	27 9		26 10	22 5		22 5	18 4	
,, 21 ...	31 6	27 10		25 3	23 7		22 6	18 5	
,, 28 ...	31 6	27 8		25 4	23 7		22 10	18 5	
June 4 ...	31 3	27 6		25 1	23 10		22 11	18 4	
,, 11 ...	30 11	27 8		24 3	21 5		23 8	18 7	
,, 18 ...	30 6	27 6		23 8	20 7		22 0	18 3	
,, 25 ...	30 5	27 6		23 5	22 0		22 9	18 6	
July 2 ...	30 8	27 9		24 3	20 7		22 5	18 6	
,, 9 ...	30 10	28 1		25 5	19 11		22 10	18 3	
,, 16 ...	30 11	28 3		24 8	20 5		22 10	18 7	
,, 23 ...	31 5	28 7		23 8	20 10		22 8	18 5	
,, 30 ...	31 8	28 11		25 0	21 0		22 10	18 6	
Aug. 6 ...	31 7	29 3		24 11	20 1		22 11	18 8	
,, 13 ...	31 7	29 11		24 9	21 3		21 2	18 10	
,, 20 ...	31 5	29 9		22 10	20 4		21 11	18 6	
,, 27 ...	31 7	30 0		26 2	22 3		19 0	18 7	
Sept. 3 ...	29 9	30 3		24 6	22 5		19 10	18 5	
,, 10 ...	27 10	28 6		27 5	22 4		18 2	17 0	
,, 17 ...	27 1	27 5		26 4	24 2		18 4	16 4	
,, 24 ...	26 6	27 0		26 4	24 0		17 0	16 2	
Oct. 1 ...	25 10	26 3		25 11	23 9		17 5	15 9	
,, 8 ...	25 5	25 10		26 2	23 8		17 2	15 6	
,, 15 ...	25 1	25 8		26 1	23 9		17 0	15 5	
,, 22 ...	24 11	25 10		26 4	23 7		17 0	15 8	
,, 29 ...	25 0	26 0		26 7	24 2		17 3	15 8	
Nov. 5 ...	25 1	26 4		26 3	24 3		17 2	15 9	
,, 12 ...	25 0	26 9		25 11	24 6		17 3	15 9	
,, 19 ...	24 11	26 9		25 6	24 3		17 2	15 10	
,, 26 ...	25 0	26 6		24 11	23 11		17 0	15 11	
Dec. 3 ...	25 1	26 8		24 4	23 9		16 0	15 9	
,, 10 ...	25 0	26 7		24 3	23 2		16 10	15 9	
,, 17 ...	24 10	26 9		24 2	23 0		16 10	15 7	
,, 24 ...	24 10	26 5		24 1	22 5		16 8	15 6	
,, 31 ...									

AVERAGE PRICES of WHEAT, BARLEY, and OATS, per IMPERIAL QUARTER in BELGIUM in the under-mentioned Months of 1903 and 1904, with Mean Prices for the Year 1903.

Month.	Wheat.		Barley.		Oats.	
	s.	d.	s.	d.	s.	d.
November, 1903...	28	7	21	6	15	5
December ,, ...	28	10	21	5	15	9
Mean of the year 1903	28	5	22	1	17	2
January, 1904	28	2	21	5	15	9

The above prices have been compiled from the official monthly averages published in the *Moniteur Belge*.

AVERAGE PRICES of WHEAT, BARLEY, and OATS, per IMPERIAL QUARTER at LONDON and BERLIN, in the under-mentioned Months of 1903 and 1904, with the Mean Prices for the Year 1903.

MONTH.	LONDON.		BERLIN.	
WHEAT.				
	Per Qr.		Per Qr.	
	s.	d.	s.	d.
November, 1903	26	10	34	9
December, ,, ...	27	0	35	6
Mean of the year 1903	27	3	35	2
January, 1904	27	6	35	7
February, ,, ...	27	10	—	
BARLEY.				
	Per Qr.		Per Qr.	
	s.	d.	s.	d.
November, 1903	24	6	23	2*
December, ,, ...	22	6	23	2*
Mean of the year 1903	22	3	23	4*
January, 1904	21	2	23	0*
February, ,, ...	21	3	—	
OATS.				
	Per Qr.		Per Qr.	
	s.	d.	s.	d.
November, 1903	16	4	18	7
December, ,, ...	16	1	18	4
Mean of the year 1903	17	9	19	4
January, 1904	16	3	18	3
February, ,, ...	16	6	—	

NOTE.—The London quotations represent the price of British corn as returned under the Corn Returns Act, 1882; the quotations for Berlin are the average prices published monthly in the *Monatliche Nachweise über den auswärtigen Handel des deutschen Zollgebiets*.

* Prices at Breslau; no quotations for Berlin.

AVERAGE VALUE per IMPERIAL QUARTER OF WHEAT IMPORTED into the UNITED KINGDOM from the under-mentioned Foreign Countries and British Possessions in the years 1901, 1902, and 1903.

Countries from which Exported.	Average Value per Imperial Quarter.		
	1901.	1902.	1903.
	s. d.	s. d.	s. d.
Argentine Republic	28 4	29 1	28 6
Chile	—	29 0	30 0
Germany	29 11	28 3	29 2
Bulgaria	24 7	25 3	—
Roumania	26 7	27 6	28 10
Russia	28 2	28 2	29 0
Turkey	25 1	25 11	27 0
U.S. of America { Atlantic ...	28 6	28 5	29 9
U.S. of America { Pacific	28 7	29 4	30 5
India, British	26 7	28 6	28 5
North America, British	28 4	28 9	29 8
Australia	29 0	30 5	—
New Zealand	27 10	29 6	—

PRICES OF WOOL.

AVERAGE PRICES of ENGLISH WOOL, per pack of 240 lb., in the under-mentioned Months of 1903 and 1904.

(*Compiled from the "Economist."*)

DESCRIPTION.	December, 1903.	January, 1904.	February, 1904.
	£ s. d. £ s. d.	£ s. d. £ s. d.	£ s. d. £ s. d.
South Down ...	8 10 0 to 11 10 0	8 10 0 to 11 10 0	8 10 0 to 11 10 0
Half-breds ...	8 1 3 " 8 11 3	8 6 0 " 8 14 0	8 10 0 " 9 0 0
Leicester ...	7 5 0 " 7 15 0	7 9 0 " 7 19 0	7 10 0 " 8 0 0
Kent Fleeces ...	8 0 0 " 8 15 0	8 0 0 " 8 13 0	8 0 0 " 8 10 0

AVERAGE WHOLESALE PRICES of BUTTER, MARGARINE, and CHEESE in the under-mentioned Months of 1903 and 1904.

(Compiled from the "Grocer.")

DESCRIPTION.	DECEMBER, 1903.				JANUARY, 1904.				FEBRUARY,* 1904.			
	Per Cwt.*				Per Cwt.*				Per Cwt.*			
	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
BUTTER:												
Cork, 1sts	101	3 to	—		109	3 to	—		102	6 to	—	
,, 2nds	91	0 ,,	—		97	6 ,,	—		92	6 ,,	—	
,, 3rds	86	3 ,,	—		83	6 ,,	—		80	3 ,,	—	
,, 4ths	74	0 ,,	—		68	,,	—		72	9 ,,	—	
Irish Creameries ...	106	0 ,,	108	0	—	,,	—		—	,,	—	
,, Factories ...	88	0 ,,	98	0	87	6 ,,	92	0	88	0 ,,	92	0
Dutch, Creameries ...	104	0 ,,	108	0	102	9 ,,	107	3	109	6 ,,	112	6
,, Rolls, boxes ...	12	0 ,,	13	0	12	0 ,,	13	1	12	4 ,,	13	6
French, extra mild ...	98	0 ,,	102	0	102	0 ,,	104	0	103	6 ,,	106	6
,, best ordinary ...	92	0 ,,	94	0	95	3 ,,	97	3	97	6 ,,	100	0
,, 2nds and inferior ...	70	0 ,,	86	0	76	9 ,,	91	3	79	6 ,,	94	0
,, Fresh, Paris baskets	101	0 ,,	105	0	102	9 ,,	104	9	104	3 ,,	107	0
,, Rolls, per doz. ...	9	6 ,,	13	6	10	1 ,,	14	1	10	3 ,,	14	4
Italian Rolls, per doz.	11	0 ,,	12	9	10	8 ,,	12	8	10	6 ,,	12	10
Danish and Swedish ...	112	6 ,,	115	6	107	9 ,,	111	9	111	3 ,,	114	0
Russian and Siberian ...	79	0 ,,	95	0	77	3 ,,	94	0	81	6 ,,	95	6
Argentine	94	6 ,,	102	0	85	6 ,,	96	6	86	0 ,,	97	0
Colonial, fine	95	0 ,,	103	6	90	6 ,,	97	6	91	6 ,,	98	6
,, good and inferior	77	0 ,,	91	0	74	6 ,,	86	9	73	0 ,,	87	0
Canadian Creameries ...	90	0 ,,	95	6	—	,,	—		—	,,	—	
,, Dairies	83	0 ,,	88	0	—	,,	—		—	,,	—	
MARGARINE	30	0 ,,	46	0	30	0 ,,	46	0	31	0 ,,	47	0
CHEESE, ENGLISH:												
Cheddar, new	56	6 ,,	74	0	56	0 ,,	74	0	58	0 ,,	74	0
,, loaf	66	0 ,,	68	0	66	0 ,,	68	0	67	0 ,,	69	0
Wiltshire ,, ...	74	0 ,,	76	0	74	0 ,,	76	0	74	0 ,,	76	0
Double Gloucester ...	65	0 ,,	68	6	64	0 ,,	68	0	62	0 ,,	70	0
Derby Factory... ...	56	0 ,,	60	0	56	0 ,,	60	0	56	0 ,,	60	0

* Except where otherwise stated.

WEEKLY PRICES (WHOLESALE) of VEGETABLES and FRUIT at COVENT GARDEN MARKET in each week of February, 1904.

(Compiled from the "Gardeners' Chronicle.")

Description.	Week ending February 3rd.		February 10th.		February 17th.		February 24th.	
VEGETABLES—	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
Artichokes, Globe, doz.	3 6	to —	5 0	to —	2 6	to 4 0	2 6	to 3 0
,, Jerusalem, sieve	1 0	,, 1 3	1 0	—	1 0	,, 1 3	1 0	,, 1 3
Asparagus, Eng., bndl.	6 0	—	6 0	,, 7 0	6 0	,, 7 0	6 0	—
Beans, Dwarf, per lb.	2 6	—	3 0	—	2 6	,, 3 0	2 6	—
Beetroots, bushel	2 6	,, 3 6	2 6	,, 3 6	2 6	,, 3 0	2 6	,, 3 0
Brussels Sprouts, sieve	1 3	,, 2 9	1 3	,, 1 9	1 0	,, 1 6	1 0	,, 1 6
Cabbage, per tally	2 0	,, 3 6	4 0	,, 5 0	4 0	,, 5 0	—	—
Carrots, dozen bunches	2 0	,, 2 6	2 0	,, 2 6	2 0	,, 2 6	2 0	,, 2 6
,, bag	2 0	,, 4 0	2 0	,, 4 0	2 0	,, 4 0	2 0	,, 4 0
Cauliflowers, per doz.	1 6	,, 2 6	1 6	,, 2 6	1 6	,, 3 0	1 6	,, 2 6
Celery, per doz. bndls.	10 0	,, 16 0	10 0	,, 16 0	12 0	,, 20 0	12 0	,, 20 0
Cress, per doz. punnets	0 8	,, 1 0	0 8	,, 1 0	0 8	,, 1 0	0 8	,, 1 0
Cucumbers, per doz.	7 0	,, 10 0	6 0	,, 8 0	6 0	,, 8 0	3 6	,, 4 6
Endive, per dozen	1 6	—	2 0	—	2 0	—	1 9	—
Garlic, per lb.	0 3	—	0 3	—	0 3	—	0 3	—
Horseradish, foreign, per bunch	1 0	,, 1 6	1 0	,, 1 6	1 0	,, 1 6	1 0	,, 1 6
Leeks, per doz. bnchs.	1 0	,, 1 6	1 0	—	1 0	—	1 0	—
Lettuces, cabbage, doz.	1 0	,, 1 3	1 0	,, 1 3	1 0	,, 1 2	1 0	—
Mint, per doz. bundles	6 0	,, 10 0	4 0	,, 12 0	4 0	,, 8 0	4 0	,, 6 0
Mushrooms, House, lb.	1 0	,, 1 6	0 9	,, 1 0	1 0	—	0 8	,, 1 0
Onions, per bag	3 0	,, 6 6	3 6	,, 7 6	3 6	,, 7 0	3 3	,, 7 0
,, per case	6 0	,, 6 6	6 0	,, 6 6	6 0	,, 6 6	6 6	,, 7 0
,, English, cwt.	7 6	—	7 6	—	7 0	,, 7 6	7 0	,, 7 6
,, picklers, sieve	3 0	,, 5 0	3 0	,, 5 0	3 0	,, 5 0	3 0	,, 5 0
Parsley, doz. bunches	3 0	—	3 0	,, 4 0	3 0	,, 4 0	3 0	,, 4 0
,, per sieve	1 6	—	2 6	—	1 6	,, 2 6	1 6	,, 2 0
Parsnips, per bag	2 0	,, 2 6	2 0	,, 2 6	2 0	,, 2 6	2 0	,, 2 6
Potatoes, per ton	80 0	,, 130 0	80 0	,, 130 0	80 0	,, 130 0	80 0	,, 130 0
,, new Teneriffe, per cwt.	14 0	,, 16 0	16 0	,, 18 0	14 0	,, 16 0	14 0	—
,, framed per lb.	0 7	,, 0 7½	0 7	,, 0 8	0 7	,, 0 8	0 6	,, 0 8
Radishes, doz. bunches	0 9	,, 1 0	1 0	,, 1 3	1 0	,, 1 3	0 10	,, 1 0
Rhubarb, York, doz.	0 9	,, 1 0	1 0	,, 1 2	0 10½	,, 1 2	0 10½	,, 1 1
Salad, small, punnets, per doz.	0 8	,, 1 0	0 8	,, 1 0	0 8	,, 1 0	0 8	,, 1 0
Savoys, tally	3 0	,, 4 0	3 0	,, 4 0	3 6	,, 6 0	3 6	,, 5 0
Seakale, punnets, doz.	10 0	,, 14 0	12 0	,, 15 0	12 0	,, 15 0	15 0	,, 18 0
Shallots, per lb.	0 1½	,, 0 2	0 2	,, 0 3	0 2	,, 0 3	0 2	,, 0 3
Spinach, per bushel	3 6	,, 4 0	2 6	,, 3 0	3 6	,, 4 0	3 0	,, 4 0
Tomatoes, Canary deeps	3 6	,, 4 6	3 0	,, 4 6	3 0	,, 4 0	3 0	,, 4 0
Turnips, doz. bunches	1 6	,, 2 0	1 6	,, 2 0	1 6	,, 2 0	1 6	,, 2 0
,, bag	1 6	,, 2 6	1 6	,, 2 6	2 0	,, 2 6	2 0	—
Watercress, doz. bnchs	0 6	,, 0 8	0 6	,, 0 8	0 6	,, 0 8	0 6	,, 0 8
FRUIT—								
Apples, home-grown, cookers, bushel	3 0	,, 5 0	3 0	,, 5 0	3 0	,, 5 0	3 0	,, 5 0
,, American, case	7 6	,, 14 0	8 6	,, 13 0	8 6	,, 14 0	8 0	,, 12 0
Cobnuts, per lb.	0 6	,, 0 7	0 7	—	0 7	—	0 7	—
Grapes, Gros Colmar A per lb.	1 9	,, 2 6	2 0	,, 2 6	2 6	,, 3 0	2 0	,, 3 0
,, B ,,	1 0	,, 1 6	1 3	,, 1 9	1 3	,, 1 9	1 3	,, 1 9
,, Alicante, lb.	1 0	,, 2 0	1 4	,, 2 6	1 3	,, 2 6	1 3	,, 2 6
,, Muscats, A, lb.	6 0	,, 8 0	—	—	—	—	—	—
,, Almeria, per dz.	4 0	,, 8 0	4 0	,, 8 0	4 0	,, 8 0	4 0	,, 8 0
Pears, per case	14 6	—	15 0	—	14 0	—	12 6	—
,, stewing	9 0	,, 11 0	9 0	,, 11 0	9 0	,, 11 0	9 0	,, 11 0

DISEASES OF ANIMALS ACTS, 1894 to 1903.

NUMBER of OUTBREAKS, and of ANIMALS Attacked or Slaughtered.

GREAT BRITAIN.

(From the Returns of the Board of Agriculture and Fisheries.)

DISEASE.	QUARTER ENDED.		12 MONTHS ENDED.	
	Dec., 1903.	Dec., 1902.	Dec., 1903.	Dec., 1902.
Foot-and-Mouth Disease :—				
Outbreaks	—	—	—	1
Animals attacked	—	—	—	120
Swine-Fever :—				
Outbreaks	293	365	1,478	1,688
Swine Slaughtered as diseased or exposed to infection ...	1,793	2,004	7,933	8,263
Rabies :—				
Number of Cases :—				
Dogs	—	1	—	13
Other Animals	—	1	—	12
Anthrax :—				
Outbreaks	182	158	767	678
Animals attacked	256	202	1,143	1,032
Glanders (including Farcy) :—				
Outbreaks	306	271	1,456	1,155
Animals attacked	562	464	2,499	2,040
Sheep-Scab :—				
Outbreaks	715	586	1,833	1,664
Animals attacked	10,754	8,052	24,431	21,523

IRELAND.

(From the Returns of the Department of Agriculture and Technical Instruction for Ireland.)

DISEASE.	QUARTER ENDED.		12 MONTHS ENDED.	
	Dec., 1903.	Dec., 1902.	Dec., 1903.	Dec., 1902.
Swine-Fever :—				
Outbreaks	27	19	172	166
Swine Slaughtered as diseased or exposed to infection ...	1,171	242	4,307	3,162
Rabies :—				
Number of Cases :—				
Dogs	—	—	2	—
Anthrax :—				
Outbreaks	2	—	4	—
Animals attacked	8	—	11	—
Glanders (including Farcy) :—				
Outbreaks	2	2	4	10
Animals attacked	3	8	6	43
Sheep-Scab :—				
Outbreaks	248	166	655	613

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OLD AGE PENSIONS.—IMMEDIATE LIFE ANNUITIES.

This Table shows the cost of an Immediate Life Annuity of £1, and an Annuity of a larger amount costs a larger sum in exact proportion. For instance, a Pension of £10 a year would cost ten times the amount given below.

AGE at time of Purchase.	Males. Cost of an Immediate Annuity of £1.			Females. Cost of an Immediate Annuity of £1.		
	£	s.	d.	£	s.	d.
5 and under 6	25	19	0	27	12	6
6 ,, 7	25	15	1	27	9	1
7 ,, 8	25	11	1	27	5	8
8 ,, 9	25	7	0	27	2	2
9 ,, 10	25	2	11	26	18	8
10 ,, 11	24	18	10	26	15	1
11 ,, 12	24	14	9	26	11	6
12 ,, 13	24	10	6	26	7	10
13 ,, 14	24	6	4	26	4	1
14 ,, 15	24	2	1	26	0	4
15 ,, 16	23	17	10	25	16	6
16 ,, 17	23	13	6	25	12	7
17 ,, 18	23	9	1	25	8	8
18 ,, 19	23	4	9	25	4	8
19 ,, 20	23	0	4	25	0	8
20 ,, 21	22	15	10	24	16	6
21 ,, 22	22	11	4	24	12	4
22 ,, 23	22	6	9	24	8	1
23 ,, 24	22	2	3	24	3	10
24 ,, 25	21	17	7	23	19	5
25 ,, 26	21	12	11	23	15	0
26 ,, 27	21	8	3	23	10	6
27 ,, 28	21	3	6	23	5	11
28 ,, 29	20	18	9	23	1	3
29 ,, 30	20	13	11	22	16	6
30 ,, 31	20	9	1	22	11	8
31 ,, 32	20	4	2	22	6	9
32 ,, 33	19	19	2	22	1	9
33 ,, 34	19	14	2	21	16	7
34 ,, 35	19	9	2	21	11	5
35 ,, 36	19	4	1	21	6	2
36 ,, 37	18	18	11	21	0	9
37 ,, 38	18	13	9	20	15	3
38 ,, 39	18	8	6	20	9	7
39 ,, 40	18	3	2	20	3	11
40 ,, 41	17	17	10	19	18	0
41 ,, 42	17	12	4	19	12	1
42 ,, 43	17	6	10	19	5	11
43 ,, 44	17	1	4	18	19	8
44 and under 45	16	15	8	18	13	3
45 ,, 46	16	9	11	18	6	9
46 ,, 47	16	4	2	18	0	0
47 ,, 48	15	18	3	17	13	2
48 ,, 49	15	12	3	17	6	1
49 ,, 50	15	6	1	16	18	11
50 ,, 51	14	19	11	16	11	9
51 ,, 52	14	13	6	16	4	7
52 ,, 53	14	7	1	15	17	4
53 ,, 54	14	0	5	15	9	11
54 ,, 55	13	13	8	15	2	4
55 ,, 56	13	6	9	14	14	9
56 ,, 57	12	19	8	14	6	11
57 ,, 58	12	12	5	13	19	0
58 ,, 59	12	4	11	13	11	1
59 ,, 60	11	17	4	13	3	1
60 ,, 61	11	9	8	12	15	1
61 ,, 62	11	2	2	12	7	0
62 ,, 63	10	14	11	11	19	0
63 ,, 64	10	7	8	11	11	0
64 ,, 65	10	0	6	11	2	11
65 ,, 66	9	13	4	10	14	7
66 ,, 67	9	6	4	10	6	4
67 ,, 68	8	19	7	9	18	1
68 ,, 69	8	12	10	9	9	10
69 ,, 70	8	6	2	9	1	10
70 ,, 71	7	19	5	8	14	2
71 ,, 72	7	12	10	8	6	10
72 ,, 73	7	6	4	7	19	10
73 ,, 74	7	0	1	7	13	0
74 ,, 75	6	14	1	7	6	4
75 ,, 76	6	8	4	6	19	10
76 ,, 77	6	2	8	6	13	7
77 ,, 78	5	17	4	6	7	5
78 ,, 79	5	12	3	6	1	6
79 ,, 80	5	7	2	5	15	9
80 or any greater age.	5	2	4	5	10	3

LIST OF LEAFLETS ISSUED BY THE BOARD OF AGRICULTURE AND FISHERIES.

(a.) Leaflets dealing with Insects and Fungi injurious to Crops.

No.	Title.	No.	Title.
1	Black Currant Mite.	46	Stem Eelworm.
2	Vine, Plum, Hop and Raspberry Weevils.	47	Asparagus Beetle.
		48	Pea and Bean Thrips. or Black Fly.
3	"Flea" Beetles.	49	Fruit Tree Beetle.
4	Winter Moths.	52	Gooseberry Mildew.
5	Mangold Fly.	53	Pear Midge.
10	Wireworms.	56	Canker Fungus.
11	Daddy Longlegs or Crane Fly.	60	Goat Moth & Wood Leopard Moth.
12	Gooseberry Saw Fly.	62	Pear and Cherry Saw Fly
14	Raspberry Moth.	64	White Root Rot.
15	Apple Blossom Weevil	65	Small Ermine Moths.
16	Apple Sucker.	68	Currant Aphides.
19	Pea and Bean Weevils.	69	Tent Caterpillars.
20	The Magpie Moth.	70	Winter Washing of Fruit Trees.
22	Diamond-back Moth.	75	Root-knot Disease in Cucumbers and Tomatoes.
23	Potato Disease.		
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(b.) Leaflets dealing with Wild Birds.

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40	Kestrel or Wind-hover.	50	Water Wagtails or "Dishwashers."
42	Short-Eared Owl.	51	White or Barn Owl.
43	Titmice.	54	Spotted Flycatcher.
44	Lapwing, Green Plover, or Peewit.	55	Swallow.
45	Starling.	84	House Sparrow.

(c.) Leaflets dealing with Animals, including Poultry.

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13	Acorn Poisoning.	78	Liver Disease of Poultry.
21	Warble Flies.	81	A Substitute for Dishorning.
28	Anthrax.	82	Preparation of Wool for Market.
29	Swine Fever.	83	Preservation of Eggs.
57	External Parasites of Poultry.	89	Fluke, or Liver Rot in Sheep.
58	Internal Parasites of Poultry.	95	Ringworm in Calves.
61	Sheep Scab.	96	Parturient Apoplexy.
67	Favus in Poultry.	100	Pig Breeding and Feeding.

(d.) Leaflets relating to Acts of Parliament.

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8	Farmers and Assessments to Local Rates.	27	Remission of Tithe Rentcharge.
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26	Farmers and the Income Tax.	66	Workmen's Compensation Act, 1900.

(e.) Leaflets dealing with Miscellaneous Subjects.

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6	Voles and their Enemies.	80	Use of Artificial Manures.
9	Ensilage.	85	Haymaking.
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36	Cultivation of Osiers.	97	Farmers' Co-operative Societies.
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79	Rations for Farm Stock.		

The issue of Leaflets 7, 17, 18, 37, 59 and 71 is suspended.

Copies of these Leaflets may be obtained free of charge and post free on application to the Secretary, Board of Agriculture and Fisheries, 4, Whitehall Place, London, S.W. Letters of application so addressed need not be stamped.

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